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Introduction to the Proceedings of PDC 2002
the seventh biennial Participatory Design Conference

Since 1990, the Participatory Design Conferences have brought together researchers and practitioners from a variety of disciplines and work traditions, probing the social scope and practices of design of technology. A core concern has been to understand how collaborative design processes can be based on participation of the people affected by the technology designed.

The involvement of users and the focus on human-centered design, addressing the design of technology 'through the interface', were pioneered by contributions to the Participatory Design Conferences. Debates within the participatory design community have contributed to the development of a new IT design field emphasizing simultaneously the need for thorough studies of the context of use, the relevance of an open and participatory design process, and concern for the political aspects of the technology in use.

Today the collaborative nature of the design process and the need to involve a large variety of stakeholders has gained wider acceptance. At the same time a fundamental uncertainty concerning the scope and directions for the design of technology has created a growing interest in innovative approaches to participation and design.

With the theme *Participation and Design*, the Participatory Design Conference 2002 invited researchers, designers and other practitioners to present *inquiries into the politics, contexts and practices of collaborative design work*. We invited contributions from all design fields such as architecture, urban planning, engineering, interaction design and others (such as the fine arts) with a focus on understanding collaborative design work. The contributions assembled in these proceedings reflect this invitation.

With John Habraken and Barbara Holub two accomplished speakers from the fields of architecture and art have been invited as sources of inspiration for the debates about participation and collaborative design practice.

John Harbraken is a well-known Dutch architect who worked for many years as a professor at MIT in Boston. In his recent book The Structure of the Ordinary (MIT press, 2000) he sums up his perspectives on the built environment as always open and evolving. He has had a lifetime commitment to the idea of participation, since the late 1950's and early 60's. Harbraken's perspectives are original and provocative, genuinely interested in enabling rather than in promoting an ideological or political position. Moreover, from the start, he has been thinking about how design and participation relate to one another, rather than promoting participation and accepting the outcome, whatever that might have been.

Barbara Holub from Austria works as an artist in-between urban planning and artistic interventions with a focus on communication in public spaces. She often sets her work in contexts outside the arts – inviting people into a staged garden fence situation, collaborating with employees in developing visual statements. Stimulating participation is an occasion for questioning the routines of everyday life, exploring memories, and transcending the roles of the individual within given contexts and functions of places. Barbara Holub, who also taught at the University of Illinois at Chicago, School of Art and Design, TU Wien, has developed a variety of methods of engaging actors, from interviews to games and performances.

The proceedings are structured in four parts: full papers, work-in-progress, workshops, and art/work exhibition. It is for the first time thata PD Conference invited submissions for an art/work strand, which exhibited artwork created as part of the research process. The focus on art as process, collaborative authorship and interactivity, in the computer aided, enhanced or generated context makes exhibitions such as these of high relevance for designers. As in the arts in user-centered design process, the distinction between the designed artifact, the context of use, and the process of design may become blurred.

The themes of the academic work included in these proceedings comprise old and ongoing concerns as well as new ideas, coming from both inside and outside the PC community. Many contributions focus on methods and techniques, on how to develop design competence, involve and/or imagine users and contexts of use, examining the boundaries between design and use, discussing the roles of designers and/or participant observers in users' everyday activities or in the design process, addressing issues of power and politics.

While methods and techniques are an old topic within PD, there is an increasing diversity of methods being developed and practiced and some of them have been substantially elaborated. Also, the tradition of grounding one's research in fieldwork, ethnographic studies, and in inquiries on contexts of use has been both confirmed and strengthened. There is a shift of attention from old to relatively new contexts of use. The technologies and artifacts that are examined range from the future office to applications in health care, mobile technologies, and large distributed systems. Some of the papers explore the relationships between PD work and such varied fields as work design, engineering, interaction design, web design, product development, home services, curriculum design, architecture, and urban planning.
Although collaborative design practices are widespread there is still some way to go to better understand them on the one hand, to better connect them to political concerns with user participation and democracy on the other hand. The 'art of doing PD' continues challenging design practitioners of all kinds.

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KEYNOTE SUMMARIES

THE WAY ARTIFACTS EVOLVE IN USE
Participation as a key to a new professinalism

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To have a healthy living environment the energies of inhabitation must animate environmental change. The 'Open Building' approach, as supported by a network of practitioners and academics, seeks to re-introduce the powers of inhabitation in residential construction. They see the fine-grained large project as the future. Participation, recognizing inhabitation as the key factor, is not a goal by itself but a means to achieve a healthy and sustainable environment. It leads to new professional skills and knowledge:

1) Understanding environment.
Knowledge of the built environment as an autonomous and complex phenomenon should justify architectural intervention, much in the way knowledge of the human body must justify medical intervention. As always, patterns of change reveal constant laws. Transformation, therefore, is the key to our knowledge of environment. The concept of 'dominance' reveals itself as one of the major constants in environmental dynamics and is discussed by way of example.

2) Design methodology
Environmental change also demands distribution of design intervention. The reality of this distribution challenges Modernism's top-down centralized design ideology. Wherever design distribution takes place, coordination and interface management become important concerns. Methodology provides tools in response to them. Here again,'dominance' is illustrative. It allows us to finally discard 'function' as the basis for design, and to achieve a more open ended way of working by looking for 'capacity'.

3) Form behavior
Environmental transformation is bound to social convention as well as to physical reality. Our interventions, therefore, are not random but reflect 'form behavior' that we are innately familiar with. A new generation of CAD programs is needed to make the computer understand such 'behavior of form' as well. Once more, the concept of 'dominance' is important. It allows us to convey behavioral knowledge to the computer, making the latter a true design participant.

”May I show you my stamp collection?” -the artist as invited guest with unpredictable outcome

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our western society is based on principles of control, evaluation, validation or success, which implies that the individual is constantly called upon to mirror himself/herself according to the specific rules imposed upon him/her by his/her respective social and cultural context. this means that all our actions are much rather guided by the notion of control and awareness of “performance” commensurate with the image of the company than the “enactment of the self”*. my projects aim at questioning these roles as well as the role played by the artist in the game, and at giving space to “what doesn’t fit”.

in this presentation I would like to give you an overview of some recent projects to show my artistic interest in direct „enactment“, the strategies I’ve been developing, and how the projects can be read as an in-between for engaging in almost childlike play and yet at the same time expose precise structures of the environment or „set“ I’m investigating.

i usually try to place and/or communicate the projects both in the art context as well as in that of an enterprise or specific professional environment. questions regarding access to the situation I choose as field of artistic investigation, differ according to the given parameters. whom do I tell what? what are the expectations of the people participating - what are my expectations? what do I make visible/ communicate to the viewer, and which experience remains visible only to the participants?

the art practice I've been developing is based on creating specific sets, offering an experience to the participants, which they might not have had in their everyday life. the seemingly harmless question posed by the title of this presentation itself addresses the hidden potentials of the situation it points at. the crucial question is: what happens then? the moment of seduction, of giving up control, of submerging in the situation opens up a field of unforeseen developments.

since the artist is often still considered to be somewhat of a „court jester“ I play with this role for intruding into systems usually eager to control exactly what is supposed to happen. at the same time I, as director, have to be in control of what's happening. setting precise rules is a prerequisite for achieving a different experience, but it also questions mutual agreements, conventions and structures of hierarchy and order within society as well as patterns of producing a certain aesthetics of art. this contradiction served as basis for lars von trier and thomas vinterberg in creating „dogma“ in 1995. when they decided to adhere to very "restrictive" rules, the ‘dogma’, they more than upturned an increasingly boring and affirmative film production. their films were so ambivalent that they can no longer be reduced to questions of “what’s the message?”. their structure of production relates directly with other structures inherent to society and it is precisely this lack of distance that enables aesthetics to coincide with content. filmmaking according to "dogma" as well as art productions like mine directly mirror the social and political/ economical system we live in. the dichotomy between author and recipient/ viewer is at stake as well as the security of the safe role that goes with it. in my work I try to achieve a state of the pieces in-between fiction and documentary so that it’s up to the viewer to decide where he/she puts him/herself.

this type of art production also questions the importance of efficiency in our society. these projects offer no evaluation or measurability as guidelines for holding on. companies who have involved me as artist to produce a piece had to experience that: the artist only serves his/ her own purposes. when companies increasingly try to adopt art practices for their own interests in buying the artist as critical voice, we have to be even more critical about this/ our position along the borderline pertaining to the same system. we must nevertheless make visible those small and uncalculated individual incidents or "flaws" which add to the pleasures of life although their objective may be to contradict neo-liberal interests.

no solutions since there are no problems posed - reading society under the premise of producing an art piece means to refuse an evaluation. no fear and, to quote slavoj zizek's famous phrase: "love your symptoms like yourself".

______

* this is also the title of an exhibition curated by maia damianovic for the "steririschen herbst" in graz 2002.

PLENARY PAPERS

Participatory Design and the Collective Designer

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ABSTRACT

Is and should there be a place for the Aristotelian virtue of *phronesis* in contemporary participatory design practice and for design as an act of anxious love? In this paper we take a critical look at participatory design and reflect upon the virtues of the collective designer. Towards a background of the dreams and lost utopias of some related collective designers of the past: the Bauhaus, Nordic design and Scandinavian collective systems design, we suggest that our attention should not be on the great espoused design ideals but on the politics-in-practice of the collective designer. The really interesting collective designer in practice might very well be much more of a "machiavellian" reflective practitioner than an objective scientist or politically correct utopist.

Keywords

Bauhaus, collaboration, design, participation, *phronesis*, power, Nordic design, ethics, politics, Scandinavian collective systems design, utopia, virtue.

INTRODUCTION

Modern design was born with the Bauhaus in the beginning of the last century. It was a great political project with a background in the radical and revolutionary movements of that time in Europe. The Bauhaus designer was a collective designer and his design manifestos envisioned a new unit of art and technology in the service of the people. However, as all Utopias also the Bauhaus showed to be full of contradictions. Transformed into modernism and functionalism it produced rational living contexts of regular geometric shapes far from the dreams of the people that had to occupy them.

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Later we have had other collective designers. In Scandinavia we have had both Nordic design from the 1930s and Scandinavian collective systems design from the 1970s. Both approaches with great espoused politics as collective designers, with democratic dreams, and lost utopias.

The contemporary designers in the information age rather participate in hybrid networks of mind and matter than make modern products. Could this participation be carried out as professional wisdom and artistry taking the form of collective design as an anxious act of political love? Is this yet another espoused vain dream of democratic utopias lacking concrete power analysis, or is there action space in the new networks for the reflective collective designer to shape a new unit of art and technology in the service of the people?

This is the kind of inquiry into participatory design that we will pursue in this paper. The paper focuses attention onto the politics in practice of democratically oriented Scandinavian IT design following what we see as the collapse of the Scandinavian collective systems design tradition. In order to address this question, Scandinavian collective system design is set in the context of two earlier and influential design traditions with democratic intent: the Bauhaus and Nordic design traditions. Drawing out some of the similarities in these traditions' espousal of a grand democratic politics accompanied by a decline into a more technocratic or authoritarian practice, the paper will reflect on the need for new models of the politics in practice of collective designers, reflecting upon the concept of the collective designer, the designer as reflective practitioner and different views on design as community. Finally, we will contemplate the collective designer and participatory design after September 11.

COLLECTIVE DESIGNERS OF THE PAST

Who is a collective designer?

In this paper we use the concept of the collective designer sometimes to refer to a school or movement like the Bauhaus and sometimes to its individual members.

We do not think of the collective designer as a naïve neutral technician, nor as an independent free artist or a simple manipulator in the service of power. In general we think of the collective designer as someone who recognize the collective and political character of the design process and take a humanistic stance in design issues. What we have in mind is different aspects of the 'collectiveness' of design. We think of collective design as communities-of-practice where the situated practices are carried out in a direction towards legitimate participation and access to the communal artifacts. [26]

Such collective design communities can e.g. be communities-of-practice of professional designers, overlapping communities-of-practice between users and designers, or communities of stakeholders including not only designers and users, but also interpreters, jurors and legislators. Especially we think of collective design in terms of 'understanding others understanding' (as suggested by Krippendorff [23]) or as "being in service" (as suggested Nelson and Stolterman [38]).

Participatory design, finding its democratic legitimization in espoused participatory procedures, is one such approach to collective design.

With this understanding of the collective designer we now take a critical look at three related collective design approaches from he past with relevance to the future of participatory design: the Bauhaus from the 1920s, Nordic design from the 1930s and Scandinavian collective systems design from the 1970s.

The Bauhaus

Figure 1. Bauhaus, Dessua, 1926.

Word War One had just come to an end. Humanism, the enlightenment project and Western civilization had suffered yet another defeat. The German economy was in ruins and the political situation was most turbulent, on the verge of a social and political revolution. The Weimar republic had just been proclaimed and in 1919 the parliament had moved to the hometown of Goethe, Shiller, List, Strauss and Nietzsche. It was in this conservative environment the architect Walter Gropius managed to open Hochschule für Gestaltung Staatliches Bauhaus, the radical design school Bauhaus. The vision was to create a new style for modern men and women, to realize an approach based on idealism, community and collaboration, to unite craftsmen and artists and to design the whole human environment from simple tools to the entire architecture. With this 'collectivist approach' the Bauhaus gathered a very interesting group of radical artists and architects including Wassily Kandinsky, Paul Klee, Oscar Schlemmer, Ludwig Mies van der Rohe and Laszlo Moholy-Nagy.

'Art and technology – a new unit' became after a few years the constructivist motto for turning social utopias into industrially oriented product design and architecture. Artefacts should be transparent as to their functionality. Buildings and other artefacts should be designed to engender social change. By design of progressive social and cultural values into the artefacts, these were thought of as vehicles for change by creating the necessary conditions. [13, 17, 30, 41]

But already in 1925 the authorities in Weimar forced the school to close down. There were too many Jews and the radical activities were considered anti-German. In 1926 the Bauhaus reopened, in brand new buildings designed by Walter Gropius, as a municipal project in the more progressive Dessua. Here the first worker housing projects were designed and realized as well as many of the well known Bauhaus everyday objects. In 1932 the Bauhaus had to move again since the Nazis had taken over the city. This time to Berlin, but already in 1933 the Gestapo marched in and put a definitive stop to the Bauhaus social design experiment in Germany. Now it was the Third Reich that should be realized and in this design there was no place for the radical Bauhaus school and rational functionalism as a meeting place for art, culture and technology.

On the international scene the reception was quite different. In exile, especially in the US, the master from Bauhaus, the 'white gods' from Europe, Gropius, Moholy-Nagy and Mies van der Rohe had great success as avantgarde for the modern "international style". [20]

As the Bauhaus became celebrated as "the international style" for the salvation of the modern society, it was at the same time diminished to a program of "hard" regular geometric white shapes in steel, glass and reinforced concrete under the dictum "architecture or revolution" with the corollary that a revolution could only be avoided if the modern architects and designers were given the freedom and power to change the world. [6]

Symbolically this program died on July 15 1972. The Pruitt-

Igoe low-income building complex in St Louis was an award winning project in steel, glass and reinforced concrete designed in the "international style" by the famous architect Minoru Yamaski in the early 1950s. The purist style, based on a clean hygienic hospital metaphor, meant to install the corresponding virtues in the inhabitants. Many of them were Southern migrants without experience of living densely packed in compartments with little room for expression of individuality and traditional social activity. In short time the covered walkways became the site for vandalism, drug abuse and crime. Hence, people started to move out of this nightmare. And finally after recommendations from the residents the authorities literally blew up the building complex. [42, 5]

What had happened to the great espoused social utopias from the early Bauhaus manifestos that envisioned how 'an idealism of activity that embraces, penetrates and unites art, science, and technology and that influences research, study, and work, will construct the 'art-edifice, of Man'. [36]

Despite the high moral and aesthetic principles, there was no real feeling insight or vivid realization of ordinary peoples everyday life and conditions. The 'soft' ideas of participation and democracy, supporting and developing a constructive dialogue between design and user communities, was never a corner stone of the Bauhaus.

Figure 2. Pruitt-Igoe, St Louis, July 15, 1972.

Nordic design

After World War Two the Scandinavian countries became internationally well known for Nordic Design. But already in 1919, the same year as the Bauhaus opened in Weimar, the director of the Swedish art and craft association published the manifesto *Vackrare Vardagsvara* (More Beautiful Everyday Things) in which the functionalist motto of form follows function was made very clear. 'To say that something is beautiful is to say that it has properties that make us happy and satisfies us, make us feel good. (…) Our demand on form is a demand on truth, and what we want to put an end to are such forms that belonged to craft and craft tools but that are alien to the machines. Instead we want to design in accordance with the new technology. By truth we also mean usability. The use of an artefact must be clearly expressed in its form' [33]

However, the real breakthrough of functionalism and the legacy from Bauhaus came with the Stockholm exhibition 1930 and the *acceptera* (accept) manifesto by Gunnar Asplund and other leading functionalist architects and designers. [3] Here the espoused vision of the interplay between art, technology and politics was made very clear. The belief in industrial development and progress was strong. Social problems could be solved with scientific rationality. Salubrious and functional compartments, cloth and everyday objects for the many was to be industrially produced and craftwork subsumed under this industrial production. "Funkis" as functionalism was nicknamed became synonymous with the growing working class or at least with the social democratic parties welfare ideology 'folkhemmet'. [22, 39, 40] The legacy from Bauhaus was obvious in what became known as Nordic design, but the forms were somewhat more inviting and warmer. Soft curves rather than German exactness, wood rather than metal, a more nuances than the basic colors proclaimed by the Bauhaus.

Some of the most radical and prominent Nordic design architects and designers were Danish e.g. Arne Jacobsen, Poul Henningsen, Børge Mogensen, Hans J. Wegner and Jørn Utzon. However, interestingly enough, in Denmark it was clearly the cultivated bourgeois middle-class that made the style their own. What in Sweden first and foremost was perceived as a political conviction was in Denmark more of a style, literally known as the 'white style'. And in Sweden, despite the initial utopian visions, the reality of Nordic design was perhaps more of an elitist doctrine from above than an approach based in democracy and participation of thus concerned. Today the national and international interest in Nordic design is really more retrospective and nostalgic than visionary for the future (and the prices for Nordic design items from the grand days are sky rocketing).

Rather contemporary Nordic design has become synonymous with IKEA. The furniture company has made the Nordic design utopia of more beautiful everyday things for the people to the official company vision and literally 'democratic design' a trade mark.

Scandinavian collective systems design

'So the impact of Utopia is continuing to expand, and the idea that workers and their unions have an important role in the design of new technology is reaching a wider and wider audience. Today Scandinavia, tomorrow, perhaps, the rest of the world.' [21]

This was the concluding remark in a most appreciative article in MIT Technology Review 1985 on UTOPIA, a Scandinavian participatory design project (see e.g. [10, 15, 19] The appreciation of the Scandinavian collective systems design as a way to democratize the design of information technology, was growing internationally, not least in the US, as also exemplified by the American produced film *Computers in Context* in 1986. [12]

The UTOPIA project was a Nordic cooperation that specifically concerned newspaper production and new page-make up and image processing based on the emerging workstation and display technology. The technology was developed in close cooperation between graphic workers, their trade unions and systems designers (computer scientists as well as product designers). The design was based on the, at that time rather unusual and politically provocative idea, that the technology could and should be designed from work practice and be skill enhancing rather than deskilling. To achieve these goals a number of participative methods and techniques like extensive use of mock-ups and early prototypes in combination with different design games were applied in novel participatory ways forming the Scandinavian collective systems design approach (see e.g. [8, 10, 15, 19, 29, 34]).

But the story of Scandinavian collective systems design started in Norway fifteen years earlier. In a pioneering project from 1970 the Norwegian Iron and Metal Workers Union in cooperation with Kristen Nygaard, one of the inventors of object oriented programming, and other researchers from the Norwegian Computing Center took the initiative to a project towards democratization of the design and use of information technology at work. [32] The strategy aimed at creating a process which would build up knowledge and activities at all levels within the trade union, with the main emphasis at the shop floor level and participative production of knowledge that could be actively use in the daily work at the factories, the local unions, or the national unions. The strategy was developed under influence of the highly successful local activity strategy of the Norwegian anti-European Economic Community movement. (It may be worth noticing that Kristen Nygaard in the 1990s became the national leader of the second Norwegian anti European Community movement).

One of the most tangible outcomes of this project was the *data agreements*. These agreements primarily regulated the design and introduction of computer-based systems, especially acquisition of information and also led to a election of numerous so-called data shop stewards. Among other things the central agreement stated:

‘Through the shop stewards the management must keep the employees orientated about matters which lie within the area of the agreement, in such a way that the shop stewards can put forward their points of view as early as possible, and before the management puts its decisions into effect. The orientation must be given in a well-arranged form and in a language that can be understood by non-specialists. It is a condition that the representatives of the employees have the opportunity to make themselves acquainted with general questions concerning the influence of computer-based systems on matters that are of importance to the employees. The representatives must have access to all documentation about software and hardware within the area of the agreement.’ [31]

The project strongly inspired trade union strategy, as well as national legislation and collective agreements on the design and use of information technology throughout Scandinavia. Also, several new research projects refined the Scandinavian collective systems design approach, but the extent and impact of these activities did not meet the initial expectations. It seemed that one could only influence the introduction of the technology, the training, and the organization of work to a certain degree. From a union perspective, important aspects like the opportunity to further develop skill and increase influence on work organization were limited. Societal constraints, especially concerning power and resources, had been underestimated, and in addition the existing technology constituted significant limits to the feasibility of finding alternative local solutions which were desirable from a worker perspective.

As an attempt to broaden the scope of the available technology the main idea of the first projects, to support democratization of the design process, was complemented by the idea of designing tools and environments for skilled work and good use quality products and services. It was to try out and demonstrate this ideas in practice that the UTOPIA project was started.

Scandinavian collective systems design took place in the 1970s and 1980s in the era of democratization of the workplace in Scandinavia, when the belief in ‘folkhemmet’ (the peoples home), the Scandinavian version of the welfare state still was strong. Management opposed to changes in work suggested by the trade union. The trade union opposed to the technology suggested by management. However, trade union understanding of new technology increased and a trade union strategy on design and use of information technology was developed. Contributions to important changes in laws and agreements were made, but the work itself did not really become more ‘rewarding’.

Today the legitimacy of trade unions is questioned, and ‘folkhemmet’ is rapidly de-mounted as are laws and agreements on the design and use of information technology. Production has not really changed in the radical participatory direction as suggested by the Scandinavian collective systems design approach more than twenty years ago. At the same time productivity has increased, work has, somewhat contradictorily, become both more 'rewarding' and more stressful, and top management supports many more or less restricted versions of participation. [16]

When Scandinavian collective systems design in the 1990s become a 'success' in the US as participatory design it was not really for political reasons of democratization in the workplace. While the philosophy of participative design had some influence in the academic world, in the corporate and political arena it was transformed into a form of soft technocracy, as 'user involvement' in IT design became acceptable as a software development practice. Today what remains of Scandinavian collective systems design is more at home in the academic world, than in the political arena. The researchers and systems designers are no longer collective designers, but for good and bad pretty mainstream academic researchers and designers. Looking in retrospective what remains is more a design style, and some useful methods and techniques for ethnographically oriented participatory design.

And lets face it. Despite all its participative and democratic merits and all the influence it may have had, the UTOPIA designed technology never really made it to the market. When the Nordic IT success in the market place really came it was as part of the dot com economy in which boundless individualism and hubris meant sacrificing collective design and the rigors of democratic deliberation for the pleasures of vitalist enthusiasm as politics-in-practice. It is a remarkable irony that the most internationally successful, but now also erased, of these companies Framfab (The Future Factory) had an espoused vision that echoed the collective design utopias of the Bauhaus, Nordic design and Scandinavian collective systems design. The vision vas to build 'Folkhemmet 2.0'.

Espoused utopias and politics-in-practice

So here we are with three influential design traditions all with their specific meaning of and influence on participatory design, but at the same time three collective design traditions with lost utopias and at least debatable politics-in-practice.

The great Bauhaus vision of socially responsible design was transformed into a mere style. The fantastic new unit of art and technology partly ended up as science and control, not very different from Frederick Taylor's scientific management, which was used to deskill workers during the last century. And elitism rather than a real effort of understanding others understanding seems to be a good description of the politics-in-practice that came out of the Bauhaus.

The same transformation seems to be the case with the great visions of the architects and designers behind Nordic design. The movement was intimately interwoven with the building of 'folkhemmet' and the Scandinavian welfare states but was later more or less transformed into an aesthetic style – 'the white style'. And in the end the politics-in-practice of 'funkis', the Nordic version of functionalism, became more of an international sales pitch than a social reform program.

Scandinavian collective systems design grow out of the attempts to democratise Scandinavian work places in the 1970, but has survived more as a set of creative design methods. The politics-in-practice of these collective designers is limited to the developments within the academic field and disciplines like human computer interaction and interaction design, whereas workplace design in practice is left to a new kind of political entrepreneurs with an ideology of boundless individualism far from that of the collective designer.

THE VIRTUES OF THE COLLECTIVE DESIGNER

Legitimisation of the collective designer

We have outlined three stories of collective design with grand espoused politics and major impact, but with an observable politics-in-practice often leading in other directions.

The Bauhaus found its legitimisation in the unit of art and technology based on a political commitment to reforming everyday life. Likewise Nordic design found its rationale in the production of good modern design for everyone and Scandinavian collective systems design found its good reason in support of resource weak groups and the democratisation of the workplace.

We find the legitimacy of a democratically oriented collective design process a worthy cause to fight for, but now it seems this can no longer be done by a mere return to the modern project of functionalism and progress towards utopia. The focus will have to be shifted from espoused politics, utopias and ideologies towards politics-in-practice.

Collective designers facilitate cooperation and communication across and within design and user communities of practice. The 'politics in practice' of this activity is not, however, the simplistic 'espoused theory' of democratic participation. It is also an exercise in the 'realpolitik' of 'getting things done' in practice, an activity involving inherent conflicts, tensions, coercion, manipulation and ethical and political dilemmas, as well as cooperative facilitation. If this is not recognised, the history of the collective design traditions suggests that an espoused democratic politics will prevent an accurate understanding of politics in practice and contribute in part to the emergence of a more authoritarian technologies.

Hence, rather we may ask how the collective designer 'get things done his or her way'? What role coercion, manipulation and self interest plays in the politics-in-practice of the collective designer? And what roles do the collective designer play as leader of and driving force behind collaborations and alliances?

As a general orientation towards addressing this question, what we have in mind is something like the practicum for reflective practitioners as suggested by Donald Schön [37] but now with focus on a systematic effort to develop political and other competencies to act a collective designer in practice.

Anxious acts of political love

For the collective designer this is a problem of the relation between art and technology in practice, but more fundamentally it is the relation between science and politics that is problematic. As Bruno Latour has suggested in a '(philosophical) platform for a left (European) party' this involves a fundamental questioning of the role of science as legitimization and a replacement for political judgment. [24]

In different design, art and philosophical contexts, it has been suggested that to rethink this relation it may be useful to return to Aristotle and an alternative view of knowledge to traditional Platonic dualistic models. [See e.g. 7, 18, 28] This involves a return to a time before our understanding of knowledge was completely focused on theories as explicit, abstract, universal and context independent, to a time before political practice and competence were expelled from rational knowing because of the fragile and unpredictable nature of human action, to a time before artistic practice and knowledge was discarded from rational knowing because of its sensuous, bodily and particular nature, to the time before the Aristotelian vision of ethical life, practical wisdom and the virtue of *phronesis* had not yet been suppressed.

In phronesis, wisdom and artistry as well as art and politics are one. Phronesis concerns the competence to know how to exercise judgement in particular cases. It is oriented towards analysis of values and interests in practice, based on a practical value rationality, which is pragmatic, and context dependant. Phronesis is experience-based ethics oriented towards action. [2]

Interestingly enough, as Richard Coyne has pointed out, Aristotle suggests that this competence has its ground in the politics-of-practice of collective of the household rather than in the academic context or in the market place. [11]

Phronesis, it seems, is fundamentally not concerned with statements of facts, nor prescriptions of what ought to be, but, with an expression borrowed from J.M. Bernstein, *speculative propositions enacted as anxious acts of political love*. [7]

And this is our tentative definition of the competence the collective designer should strive fore. But how? What about tensions between a commitment to democratic politics as well as to democracy as a form of interventions and manipulations by 'authentic' subjects?

Politics-in-practice, rationality and power

One strategic dilemma in acquiring the competence of enacting speculative propositions as acts of political love has to do with our understanding of the relation between politics-in-practice, rationality and power. How may design situations be characterised in terms of rationality and power, this asymmetrical relation in which, in Bent Flyvbjerg's formulation, rationality has a power that power understands, whereas power has a rationality that rationality does not understand. Will collective design be characterized by democratic utopias, as in the cases of Bauhuas, Nordic design and Scandinavian collective systems design, or must it be more subversive finding its ways for interventions through concrete and situated power analysis?

As Bent Flyvbjerg has pointed out we are faced with a kind of 'Habermasian-Foucaltian' controversy. [18]

On the one hand we have collective design as a democratic profession with a strategy of democratic visions, communication and reconciliation, standing the risk of in practice to act as naïve and idealistic 'do goodders'.

On the other hand we have collective design as political war with a strategy of power analysis, strategic actions and reconstruction, standing the risk of total cynism and the breakdown of design as profession.

In the tension between these two positions - communication versus struggle and reconciliation versus re/deconstruction - rather than from the one or the other, we find a position from which the collective designer may develop his or her speculative propositions as acts of political love.

Strange as it may sound, a kind of democratic Machiavellian emerges as the ideal for the collective designers politics-in-practice. [9, 27] This is not to say that the collective designer should turn into a cynical 'gutter designer', but to be someone able to switch strategies to suit context, nor is it to suggest that he or she is an 'amoral chameleon' or 'pragmatist', but a pragmatic change driver combined with a visionary moralist. This is not the smug unconscious hypocrisy of the moralist or the market, but a designer of integrity; doing the right thing even at a cost to themselves; sometimes however with a defensible type of compromise, deceit and hypocrisy. A sincere and realistic design approach combing pragmatic advice with an ethnographic orientation towards forms of action actually enacted.

In summary, the politics-in-practice of the collective designer may be expressed in terms of a (self)reflective humanistic design stance (as opposed to the position of the cynical professional or smug political moralist). The collective designer is conscious about political dilemmas (as opposed to the humanistic technocrat or the ‘ideological hero’). At the same time he or she is involved in political interventions (as opposed to the neutral expert, the apolitical facilitator or the distanced academic). The new role of the collective designer goes beyond the ideological and politically correct role of the modern designers from the Bauhaus, Nordic design and Scandinavian collective systems design as well as the vitalist enthusiasm and boundless individualism of postmodern free agent dot com designers. The collective designer will engage in collective reflection as opposed to striving for cheap point or hiding behind professional ignorance.

IN SEARCH OF THE COLLECTIVE DESIGNER

In the introduction to this paper we suggested that the contemp orary designers in the information age participate in hybrid networks of mind and matter rather than make modern products, and we asked if this participation could be carried out as professional wisdom and artistry taking the form of collective design as an anxious act of political love? In other publications, we have explored further the ethical and practical issues involved in acting politically in organizations [9] and as collective designers [4]. In terms of participatory design, we are also interested in further exploring the dynamics of integrating a more traditional critical theory view of politics in the Habermasian tradition with a more contemporary post-modern view of power, discourse and agency as exemplified in post-Foucaultian work. However, in this paper, for the sake of the present audience, our main concern will be to identify examples of new kinds of politics-in-practice for the collective designer, rather than dwelling on these other (albeit important) issues. Consider the following two examples of collective design in relation to September 11 and as ‘design noir’.

Collective design and the tragedy of September 11

It is a painful fact and cause for some reflection on modernism and design that the World Trade Center was designed by the same ‘international style’ architect as the dangerous and insecure Pruitt-Igoe building complex in St Louis that was blown up on recommendation of the residents.

There are however more straightforward ways to relate design issues to the tragic and inhuman attack on September 11 last year. A good example is the following message that was published by Phil Agre on his mailing list The Red Rock Eater News Service the day after the attack on World Trade Center instantly reaching colleges and design community all over the world. As a comment on the issue on security the message begin as follows:

Figure 3. World Trade Center, New York, September 11, 2001.

‘We do need to improve security, but we should not understand the need for heightened security in a broad, vague way as a cultural imperative. We do not need a police state, and we should not militarize our society. Rather, we should view security as a design problem. We have an opening now, a brief window when the airlines cannot undermine improved security in their own commercial interests. Maybe we can also force Microsoft to design its products in a secure way, rather than exposing us to the severe information security problems we've seen in the last few months with its fundamentally shoddy architectures. We should take advantage of this opening to redesign our aircraft, buildings, software, and institutions in a rational way.’ [1]

What he suggested was active participation by the design community to heighten security, but not as an uncritical and vague cry for security with the obvious risk of militarizing society. Instead he asked us as professional collective designers to see this as an opening for engagement in concrete redesign of our aircrafts, buildings, software and institutions in a more human and rational way.

Among his redesign suggestions for long ignored design problems were: the design of doors between aircraft cabins and the cockpit; the long delayed fuel tank safety; the digital aircraft electronics e.g. so that tracing can not be turned off; security procedures at check in including the design of conveyer belt and x-ray unit; the institution of airport security with minimum wage policy and the dysfunctional baggage size regulations, the identification system for personnel in airports and how identities get administered in practice, etc.

Maybe this is not as grand a utopia as that of the Bauhaus, but as the goal of a politics-in-practice of the collective designer and as a response to actual rationality and power of a new kind of internationalist designer, this might be an example of the kind of collective design practice we are searching for. A design problem of committing to safety and security in a complex 'high risk' society, while attempting to safeguard against temptations to introduce new and more intrusive forms of centralised surveillance and control. How these ethical issues are addressed, and how designer/user cooperation is facilitated by the political manoeuvrings of concerned, is a concrete example of a future important area of collective design.

Collective design as 'design noir'

A more humorous, but not necessarily less serious or relevant, approach to design practice is taken by the designers Anthony Dunne and Fiona Raby. [14]

In the contemporary hybrid networks of mind and matter they do not contribute yet another modern digital product, but a critical interpretation taking the form of tangible design proposals. For example by investigating the secret life of electronic products they hope to stimulate debate about the dominant perspective in pervasive or ubiquitous computing. They react to an industry and technologist perspective where the consumer or the user is the hero that needs to do everything as fast and easy as possible. Instead they want to provoke reflections about 'design noir', where the user or customer is a kind of anti-hero as in film noir where things not always work out or end happily. Design noir products raise questions and provoke psychological puzzles, rather than meet pragmatic needs or solve problems. Hence, with design noir there is no claim to solve human needs, but to suggest dilemmas, conflicts and ambivalence and to provide narratives where these darker feelings are expressed, explored and acted out.

One example of such design noir is the furniture from the Placebo project. A number of people got the chance to explore their 'Hertzian space', the extra-sensory electro-magnetic fields we all are surrounded by, by adopting noir products like a 'compass table' table or a 'GPS table' for a couple of month. The compass table had 25 compasses set into its surface and could react to electronic devices like laptops or mobile phones when they were placed on top of the table, but there was no intended use by the designers this had to be invented by the users. If the GPS table could not see a satellite it literally 'got lost' and the people that had adopted it moved it to a safer place.

Design noir is not glamorous with great utopias and modern heroes, but it still has a humanistic stance and a consciousness about political dilemmas. Proactive interventions in the name of design noir might very well turn out to be the kind of critical design politics-in-practice we are searching for. A practice carried out as speculative propositions and anxious acts of political love that can take us beyond modern design and challenge the Bauhaus, Nordic design and Scandinavian collective systems design by opening up for a new or at least complementary both participatory and collective design practice.

Artifacts as collective designers and participants

In this paper we have been reflecting upon the politics of collective designers and on how different actors participate in this design process. Doing this we have recommended a renewed concern with the issues and dilemmas of a 'Democratic Machiavellian' phronesis and collective design as an as an anxious act of political love.

However, so far we have left out important actors or participants in collective design: the designed artifacts. This is a serious omission of important participants in what Bruno Latour has called 'a collective of humans and nonhumans´' and in fact he has actually advocated a remodelled 'Machiavelli for machines'. So instead of a summary we will end this paper by some reflections on artifatcs and nonhumans as participants in our examples of collective design. What is the politics of these artifacts and how can they be enrolled by the collective designer in acts of political love?

In *Pandora's Hope* Latour argues that 'real artifacts are always part of institutions, trembling in their mixed status as mediators, mobilizing faraway lands and people, ready to become people or things, not knowing if they are composed of one or many, of a black box counting for one or of a labyrinth concealing multitudes'. [25]

But how is the participation of nonhumans in collective design enacted? How does crossover and exchange of properties between humans and nonhumans take place? Which are the practices of enrollment and mobilization of artifacts into the collective?

The GPS table that was 'adopted' and 'got lost' in the 'design noir' example may not have feelings or intentions, but how is it enrolled, seduced or manipulated into the collective?

Or more indisputable and decisive as in the September 11 example: the airplanes crashing into the buildings did not fly by themselves, but what hasd been delegated to them and how are they mobilized in ever expanding collectives of humans and nonhumans?

Or think about the three buildings depicted in this paper, their designers and their own participation in design.

Walter Gropius, the founder of Bauhaus designed the Bauhaus school in Dessua in 1926. With its transparent structure it became one of the landmarks of functionalism and the design dictum 'form follows function. But how has the building itself been participating in building Bauhaus as an international movement and modern design in general?

The Pruitt-Igoe low-income building complex in St Louis was designed by the famous modernist architect Minoru

Yamaski in the 'international style' based on a clean hygienic hospital metaphor. What prosperities and authority had been delegated to this artifact. Was it because of this politics that it on recommendation by the inhabitants was blown up in 1972? And is there in fact a rather strong influence from the Bauhaus school building on the Pruitt-Igoe artifact?

Minoru Yamaski was also the designer of World Trade Center, the very embodiment of the modern market economy, but what properties had been delegated to this artifact that does not exist any more? Which collectives of humans and nonhumans was it enrolled and mobilized in?

These questions cannot be answered here, but in design as an anxious act of political love the politics of artifacts seems just as important to take into account as that of humans.

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Prototype as a Representation in Establishing and Maintaining a Rhetorical Participation Structure

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ABSTRACT

Representations are considered to be means for better communication and collaboration in determining software requirements. Uses of representations have normally been studied in artificially created situations characterized by a harmonic common interest. Representations then can be seen as props for hearing the users' voice in requirements analysis. Two episodes in a 'real world' requirements determination session are analyzed not only in a responsive but also in a rhetoric light. A high-fidelity prototype as a representation in concert with a free flow of control could be seen to hinder the democratic determination of the requirements, and to enable rhetorical persuasion.

Keywords

Representations, requirements, participation, interaction

INTRODUCTION

Representations such as process models, use scenarios or prototypes play a salient role in the craftsmanship of the analysis and design of information systems. They can be roughly fitted into either representations of work or representations of the information system [12]. In the first one, also use scenarios of the envisioned future system are included. In both cases, a representation is not a mirror reflecting reality. Instead, it is intentionally used to represent only some of the qualities of that which is represented, i.e. *the represented* [12]. In acting as intermediaries between the participants, representations help people to focus on *the represented* in terms of opportunities and constraints [12]. Whatever *the represented* is, people intentionally construct it for the purposeful interest [24] that may be individually or collectively created (e.g. emphasis on the decrease in work load). The meaning of representations is "not simply to create images that can be appropriated to the interests of design but to understand our relationship, as work researchers, designers, and other practitioners, to those images and to the practices of representing that create them" [24, p. 63]. The represented qualities are unique, chosen and many times value-bound, even biased, interpretations of the world.

Representations can be regarded as "boundary objects" in an intentional act. Boundary objects are "plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" [23, p. 46]. They can be located in between or amongst the participants in their direct and artifact-mediated presence. This view, by implication, presumes the material nature of boundary objects. This then means that language and even body language are both excluded. Material boundary objects maintain meanings across communities of practice so that the participants (e.g. users and designers) are enabled to make sense of *the represented* from their own perspectives [2]. Boundary objects should not be seen as prescriptive intermediaries, by definition, but as "common artifacts" [19]. A common artifact is not only predictable but also a partial and negotiable model of the situation [e.g. 19]. If a common artifact crosses the boundaries of another semantic community, it will be transformed (i.e. re-interpreted). Robinson and Bannon [17] use the term "ontological drift" for this phenomenon. Robinson [18] stresses that the common artifacts that make it easy for people to know what others are doing (peripheral awareness), enable implicit communication through the used material and a common focus for resolving difficulties and negotiating compromises.

We are interested in the use and effects of employing representations in user-developer interaction. This is studied from different perspectives: A representation can be seen as a prop creating harmonious interaction, a prop that is contextually regarded either as a facilitator or an obstacle or seen even to act as intermediary in the power struggle.

Coble et al. [4] reveal the harmonious nature of communication around the User Requirements document comprised of scenarios. The authors emphasize that the document brings a common focus into the debate, serves as

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a common memory for the participants and renders smoother communication between the participants. In the project, there was also a person (on the customer team) who was able to make his visions concrete as paper prototypes. Mogensen and Trigg [14] are in step with Coble et al. in that they discuss the so-called "situation cards" as triggers for harmonious participatory design. They recognize three stages that unfold during the course of the design of an evolving artifact: the appropriation of the artifact to be used (or representation if you like), the transformation, and confronting the old and the new in the work practice. Trigg et al. [26] analyzed the level of involvement or engagement and shifts in control and initiative. Even though they show that the user in their case reacted negatively to what she saw, the prototype they used encouraged the user to tell true stories of her work and reflect on her own work practice. This was seen to result in mutual learning in a harmonious manner. The authors then stress that the way users absorb themselves in the unfolding practices varies.

Madsen [13] also reveals the harmonious nature of communication around one kind of representation, here the documents from the work files. They are shown to bear influence over how initiatives are shifted. These documents as a representation have a twofold role. In this case, they helped designers join in on discussion. First, if designers ask questions, based on those documents, they may serve as a trigger for designers to enter the ongoing discussion. Second, designers can use these documents to bring the discussion back into the current work practice. O'Neill et al. [15] then discuss the representations in user-designer interaction in terms of their form, use, and users. If used in design, representations provide participants with a shared external model to support the cooperative activities and to delimit the interaction space of participants (that is a positive facilitator). In this case, the authors claim that the users, however, are very passive in transforming these representations. However, these external models are seen to maintain symmetric relationships between the participants.

Wilson et al. [28] then go on to show that representations can either be obstacles or facilitators in user participation. Thus they do not always invoke positive feelings. The authors noticed that users may act as passive or active participants. Some of the users found the prototypes and notations cumbersome, whereas the others did not. However, representations based on the whiteboard turned out to create a common focus for communication. Still, this interaction is rather harmonious in essence.

However, representations cannot always be seen to maintain harmonious interaction. For example, Bowers and Pycock [3, p. 303] describe requirements as "a negotiated product of argument and resistance". They also argue, using Woolgar's terminology [30], that both users and designers are in equal positions to *configure* each other. In the prototyping session they studied, it became evident that users and designers were acting so that direct refusals, requests, disagreements, and suggestions were rarely needed. Refusals, on the part of the user, were normally made in an indirect manner, for example, by reformulating the idea. Designers substituted indirect anticipation of users' troubles for direct requests. Timpka and Sjöberg [25] then studied a design session in which conversations on a certain topic were based on a scenario representation. The rules of "democratic dialogue" were followed. They recognize the rhetoric nature of interaction. The authors, however, did not explicitly reflect on the role of the scenario. They recognized three voices in the unfolded conversations: the voices of participatory design, of practice, and of engineering. The latter two talk of the product as an object. The voice of practice confronts the product in the work practice, whereas the voice of engineering addresses the opportunities and constraints of the technology.

Representations in requirements analysis do not prescriptively shape collaboration [2]. Based on this statement, I recognize that people are employing representations in their intentional acts, and in this manner, even exerting power upon others. Power can be defined, according to Fairclough [6, p. 89], as located in both ideological structures shaping social events and those events themselves reproducing and transforming the underlying structures. So far, however, the use of representations is mainly studied in participatory design sessions where the participation structure is based on the rules of "democratic dialogue" to some extent. By contrast, I have also analyzed the rhetoric nature of a session in which interacting participants use representations to create situational conditions for the emerging interaction.

In many of the past studies, the responsive (i.e. reciprocal, symmetric and harmonious) nature of the user-designer interaction is first created and then studied. Bowers and Pycock [3] make an exception, but even though they recognize the existence of arguments and the resistance in human acts, they still build upon the rules of the "democratic dialogue". Another exception is a study by Timpka and Sjöberg [25] who recognize the rhetoric nature, but for their part, they do not build upon the use of representations *per se*. In addition, Sjöberg [22] discusses conflicts as outcomes of the aim to control.

In the case studied here, the use of representations is not based on the "democratic dialogue" in which the users are guaranteed an equal voice, but on a business negotiation framework. However, in both, we need to understand how typical conflicts emerge to be able to avoid unwanted interaction patterns [22]. In my study, the participation structure is situationally being negotiated by means of representations in a flow of responsive and rhetorical acts.

CASE

The software house *Incognito* and its *group Q* were involved in the implementation of a software development project for The Finnish Slot Machine Association (RAY) Funding Department to enhance the management of affairs and the communication within the interest group. RAY professes to be "a significant, widely-known organization with a legal monopoly to function as a gaming operator. (...) RAY's basic function is to raise funds through its gaming operations in order to support the work as voluntary health and welfare organizations" [www.ray.fi].

Group Q is hired to take part in the analysis, design and implementation of an information system for paying the funds to those organizations. In the project term definitions, (dated May 4, 2000) *funding proposals* are described as follows: "At the beginning of each year an organization can mail a funding proposal for the certain due item with the expected due date and installment". So far, RAY has not used any computer support for creating funding proposals. The focus here is on the requirements analysis. According to the project plan, the task of the project was "to determine the system to support the payment procedure so that this system and those supporting the supervision and preparation form a coherent whole, integrating all parts of the system".

The project was established on Dec. 29, 1999. According to the original project plan (dated on Feb. 9, 2000), the project was planned to come to an end "not later than April 30, 2000". The first of the definition meetings was already arranged in the client's meeting room on Jan. 12, 2000. Contrary to the original project plan, the definition project was finally completed only at the end of June.

I have analyzed two episodes in a meeting held on May 2, 2000. The project was approaching its end at that time. During the meeting, the new procedure for creating long-term funding proposals in the system was being negotiated. Funding Secretary Marja did not participate in the session even though she was liable for the task of creating the funding proposals, as mentioned in the documentation. It is unsure whether she was even invited. The following persons attended this session: Senior Supervisor Asko is responsible for supervising the process, taking care of the smooth proceedings of the process and ensuring that problems do not exist. He audits the Funding Secretary's suggestions, i.e. accepts, revises or rejects them. Junior Supervisor Erkki plays the same role. Manager Timo is in charge of the final acceptance of single installments, done as a kind of mass confirmation. Project Managers Keijo and Sami are from RAY's Information Systems Unit. Sami is similar to an observer, learning from the project. He joined the requirements analysis project since he was to be a project manager in the design and implementation stages. Two Designers from Incognito, Pekka and Jouni were present at the meeting. Pekka was a Project Manager on the part of Incognito. His task was to control the proceedings of the meeting. One Researcher attended the session as an observing participant. However, she did not explicitly intervene in the flow of conversation.

REPRESENTATIONS USED IN THE SESSION

So far, the participants had typically discussed around the paper-based documentation. They had had three types of primary representations: process descriptions, use cases (as diagrams and verbally described) and screen models with the accompanied verbal descriptions. This time, Designer Pekka sent a meeting invitation to the others for the next session held at RAY on May 2: "Let us aim to ensure that we have the screens that are needed". This email invitation was accompanied by screen models, a map of the transitions between the screens and a functional demonstration prototype.

The process description was a rich picture representing the whole payment procedure on a high level, as comprised of the tasks and their interrelationships along with the roles that people play in this procedure. The computerized tasks were specified verbally in the use cases from the users' point of view. These use cases included the title of the task, a general description, the actor(s), the frequency of use, the pre-conditions for use, usability requirements, how the task was to be performed, breakdowns in performance, alternative steps for performance, outcomes and additional information, if needed.

The functional high-fidelity (demonstration) prototype (projected on the silver screen during the meeting) was used to support conversation. The screen models (printouts) were duplicates of those in the demonstration prototype (see Figure 1).

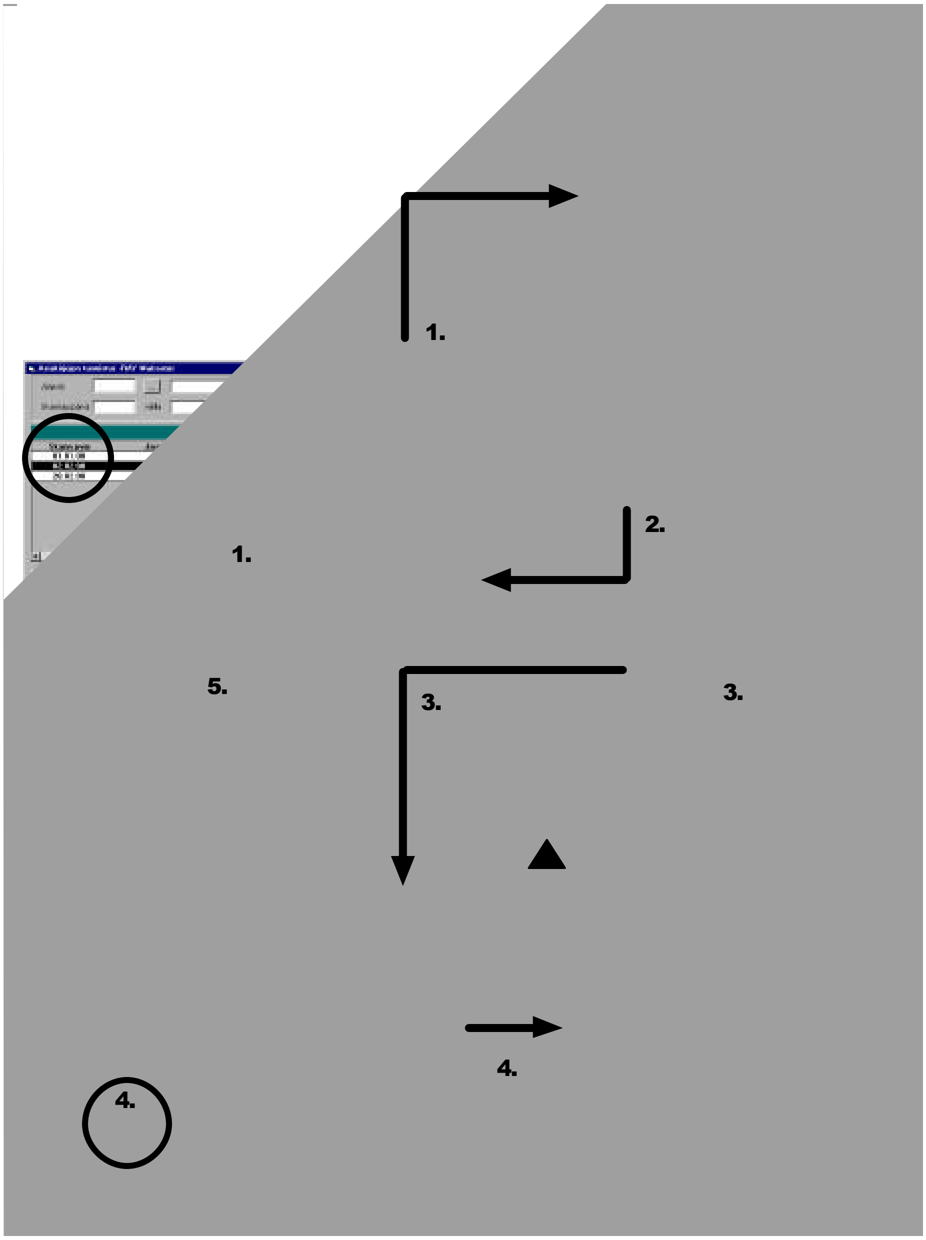
METHOD

To identify the unfolding use of representations in establishing and maintaining the action, I committed to fine-grained analysis of interaction. The session was videotaped, because "video records social events as they occur and with a level of detail that is unattainable for methods that rely on reconstruction" [11, p. 13]. Selected parts of the video were transcribed. The transcript chosen for analysis is about one minute and 20 seconds long. The transcript notation by Jefferson [29] is used (see Appendix).

I based my analysis on Fairclough's Discourse Analysis (DA). In DA, whatever the specific orientation, analysts consider language as action [6,29]. The central point is that turn-taking provides means for people in interaction to organize their inter-subjective world [27]. It is characteristic of DA that researchers recognize the existence of social discourses or 'meaning potentials' as resources that actors harness in talk-in-interaction or (re-)produced accounts [10]. DA researchers are reluctant to interpret mental intentions of the actors. Instead, they embrace whatever target-oriented action emerges, as humans act in interaction: "they [the intentions] are socially relevant because they manifest themselves as social activity" [27, p. 8]. Discursive action is rendered "socially real" in terms of its consequences [27]. If strategically or politically harnessed, this action may produce (or reproduce) asymmetric dominance and biased institutional power relationships [6]. Compared to Conversation Analysis (CA) in which a harmonious and cooperative view of interaction is produced, Fairclough's DA is sensitive to the sources of exercises of power, as well [6], and therefore used in this study.

Jordan and Henderson [11] introduce Interaction Analysis (IA) in which both the social and material worlds are analyzed in depth. I use this method in order to reveal how people support their verbal acts. In employing both DA and IA, I revolve around the language use as action supported by social and material resources, noting that text, discursive practice (i.e. the production and interpretation of text) and social structures are dialectically connected. IA introduces analysis foci for interpreting interaction [11].

Figure 1: The early stages of creating a funding proposal.



First, I identify the structure of events by defining the boundaries of events. This means recognizing the beginnings and endings of the unfolding events and transitions between them. Second, the participation structure [11] or participation framework [9] helps me to identify the way in which people establish and sustain mutual engagements and disengagements. IA also addresses the uses of artifacts and the utilization of a physical and social configuration in the unfolding interaction. Often during the course of the interaction the participants may aim to reveal their commitments to the common task orientation and focus by way of using body alignment, eye contact, tone of voice and other affordances of the situation [9,15].

To emphasize, speech acts can be used to establish either rhetorical or responsive action. If rhetorical action is established, one is presenting one's own thoughts as correct, trying to make the others to take one's side. By contrast, if responsive action is established, one acts reciprocally, reacting to the others' acts, taking turns. As a consequence, meanings are co-constructed. [20,21]. Moreover, I use the analytical concept "cultural dance" [8] to interpret the interaction. It is a metaphor to illustrate the events in which: "initiatives are like asking someone to dance with you in a way that the other(s) can either commit to acceptance or refusal" [10, p. 114].

THE CHANGING FACE OF NEGOTIATIONS

In Figure 1, the screens are taken from the final documentation. However, they are similar enough to those used in April and May to the extent that the sequence of the steps taken to create a new funding proposal can be demonstrated. These are the steps 1-4 in the use cases dated on April 14. The analyzed session was held on May 2. After this meeting, there was the new sequence for the performance of the task that is illustrated with steps 1-2 and 5 in the Figure 1. The window "Selailujen valinta" [Browse] is open, where a user can choose and open different list windows for browsing purposes. Step 1: A user finds a scanned document (a funding proposal) on the list and hits the "Asiakirjat" [Documents] button. As a consequence, the scanned document is shown on the viewer window. Step 2: The user finds out that the document is a new funding proposal. Step 3: To change the window from this to the screen "Maksusuunnitelman valinta" [Selecting the Funding Proposal], she locates "Valitse" [Choose] button and then hits it. Step 4: The user pushes the button "Uusi" [New] and is taken to the screen "Maksusuunnitelma" [Funding Proposal] to create a new proposal. She then enters the suggested due dates and installments. Since May 5, the direct link to the window "Maksusuunnitelma" was substituted for steps 3-4 (hairlines and dotted lines).

I identified two episodes in the analysis where the participation structure is changed during the course of interaction.

Episode I: Establishing and maintaining responsiveness

In this episode, the attendees are trapped by the demonstration. As a consequence, both the common object and the participation framework are created. The interaction develops in this participation framework as follows:

1 **Timo:** (1.5) that is, from here, er: (1.5) well those documents have been scanned (1.0) and that is then (.) is changed to be a funding proposal (4.0)= =and it is [chos-((en))

2 **Keijo:** [HOW does this Marja do it now that she (.) well let us look at the (.) °document identification° (.) yeah and there's only °funding proposals°

3 **Timo:** Yeah

4 **Keijo:** >That is um:< (.) there's a document clicked open

5 **Pekka:** The document ((Keijo: "Yeah")) is first checked to be open there, after that she finds that it is a propos[al

6 **Timo:** [Yeah and then she hits that button yes (4.0) she pres[ses it

7 **Jouni:** [Opens there and then (.)

Gearing up to establish responsiveness

Timo has troubles establishing collaboration **[turn 1]**. This is indicated by the manner in which he browses through his papers, trying to find something. At the same time, he verbally tries to describe his view on the tasks. He, however, has several breaks, er's and well's that indicate ambivalence to some extent. It seems that he cannot find what he is looking for. At first, the others, except for Asko, are immersed in their printouts. After taking a glance at Timo who is faltering, Jouni examines his papers and takes a look at the demonstration prototype. He starts preparing a demonstration to support Timo's efforts. By glancing at the demonstration, Keijo also shows an interest in it. Jouni again takes a look at Timo, as if trying to avoid losing contact with Timo's monologue. Soon, he starts clicking his mouse buttons. As a consequence, Asko immerses himself in what is happening on the demonstration screens. First, he corrects his posture. Then, he leans forward to look at the demonstration.

Co-establishing a participation framework

There is much faltering in Timo's speech, which makes it possible for Keijo to intervene and, by implication, consolidate collaboration. The 4 seconds break in Timo's speech opens a window for intervention **[turn 1]**. Keijo intervenes by asking: "[HOW does this Marja do it now" **[turn 2]**. His question indicates that Timo's monologue **[turn 1]** is not sufficient for creating a mutual understanding. Simultaneously, Keijo turns to the demonstration prototype. In this way, he gets the others to join in to scrutinize what is in the demonstration.

Soon, Timo takes his eyes off his printout documentation. Immediately after turning to Keijo, he notices that Keijo is immersed in the demonstration, and therefore he looks at the same object. Before his utterance "(.) well let us look at the", Keijo has a break **[turn 2]**. In this context, this is a sign of a break in his thoughts: Keijo suddenly becomes aware that what he wants to initiate is already in progress. He states "°document identification°", rendering his view shared. He is not only clarifying his own understanding of the task, but also that of the others. This is indicated by the manner in which the others soon join the unfolding participation framework.

References to the demonstration are a trigger for engaging attentions. Independent of their acts, Jouni and Keijo seem to invite the others to the dance *refreshing the memory*. During this time, the others overtly accept the invitation by re-orientating themselves towards the silver screen, one after another. It is the uttered word "document identification" that makes the others wake up. Sami becomes aware of the demonstration first. Immediately after Sami's re-orientation, Pekka looks at the demonstration, nearly shaking when waking up. Shortly, Erkki is looking intently at the silver screen. Thus, Keijo's invitation is commonly, implicitly, and even inarticulately accepted.

Unfolding responsiveness

Keijo accepts "°document identification°" as it is by uttering "yeah" **[turn 2]**. He is maintaining the dance *refreshing the memory*. As an indication of this, he continues: "there's only °funding proposals°". Timo has already been tempted to join this flowing 'waltz'. This is indicated by his responsive utterance: "Yeah" **[turn 3]**. He is maintaining the discussion without Keijo's explicit request. Sami seems to be with them in spirit. He, however, had decided to be disengaged from the definition. Asko is in 'spirit'. However, he is not sitting so erect. This may indicate a sort of partial disengagement. Erkki has, for some reason, disengaged. He is setting his wrist watch.

Maintaining responsiveness

In his initiative ">That is um:<", Keijo launches a recapitulation **[turn 4]**. He is shaking his hand, pointing out the demonstration. By means of this symbolic act, he is engaging the others' attention towards the theme that he is accentuating. The inquiring utterance "[the document] is first checked to be open there" is a reference to the past event. He refers to the recently discussed document identification screen **[turn 2]**. This indicates that Jouni has proceeded to the next screen (i.e. the viewer window on which the document is shown). Thus, Keijo implicitly requests going back to scrutinize the document identification screen. This is done by his utterance. He may, for example, find that the understanding of the screen has been weakly co-constructed (if at all). He seems keen on discussing this task in more precise detail. Pekka behaves responsively by affirming and elaborating the utterance **[turn 5]**. He verbally shares the designers' interpretation of the task. It is Jouni who then transforms this speech into the more concrete form with his demonstration. He follows Pekka and transforms verbal utterances into the concrete acts on screen.

Pekka's utterances, such as "document", "first" and "there" **[turn 5]**, indicate that Jouni has already opened the document identification screen. Pekka then utters: "she finds that it is a proposal". It cannot be known that it is a proposal before the document has been shown on the viewer window. Jouni makes use of the demonstration in order to respond to Keijo's inquiring utterance **[turn 4]**. It is Pekka who verbally echoes the steps to allow things to be shared. Actually, he is talking to the demonstration. This is, however, not a problem. The demonstration serves as a focus to be seen. It appears that Keijo already knows the answer. This is quite apparent since Keijo says "Yeah" before Pekka has even finished his response **[turn 5]**. By getting the others to revise procedures, Keijo seems to render the demonstration shared within the group.

Introducing power

Timo enters the conversation, taking this 'drifting' floor. In being responsive, his talk even overlaps the ending of Pekka's **[turn 6]**, as if ensuring his floor and being able to join in the negotiation. In responding "Yeah and then she hits that button yes", Timo verbally shares the demonstrated step **[turn 6]**. His utterance "yes" at the end is a sign of the acceptance of this step. A break follows. Jouni seeks to find the next step from his demonstration during this break. Meanwhile, the others, except for Erkki, are waiting for the next step, being all eyes. Jouni then demonstrates the step. For some reason, it is again Timo who accepts the step as it is: "she presses it" **[turn 6]**. He is not only verbally sharing but also accepting what he sees. Compared to Timo who is active, the others are passive. This control of the situation reflects the existing and unfolding power structure. For the first time, Jouni acts verbally: "Opens there and then" **[turn 7]**. First, he says "and then". Then, he has a break. In this way, he is handing the floor over to be taken by the next person. In doing so, he is still trying to sustain the responsive mode.

Episode II: Using rhetoric power

In this second episode the mode of negotiation is shifting from a responsive and commonly co-constructed acceptance to that of rhetorical acceptance of the task:

8 **Timo:** And then comes that yes (4.0) well that is that (.) that works (.) ((mumbling in the background)) and then when er Marja or somebody wants to er update the funding proposal then she or he goes er there to the list screen (1.5) via the list screen (4.5) there (.) and chooses the=

=organization (.) and due [i-((tem))

9 **Keijo:** [Wa:ait now

when first we (.) we go there so that we will not go so fast

10 **Timo:** Aha

11 **Jouni:** Do we close down this one?

12 **Keijo:** Yah

Taking over

Timo takes the floor, making it verbally visible, and accepts what is demonstrated: “then comes that yes” **[turn 8]**. Even though he is alluding to the last screen in the sequence with the abstract term “that”, the others are able to see the common object. Timo has become the person who is in a position to give approvals to pin down the steps. In nodding his head and saying “yes”, he accepts the task as it is. A break of 4 seconds follows. It is an indication of the ending of the task.

Timo, as an authority, gives a symbolic look at Keijo, Asko and Erkki, emphasizing the weight of his approval. He does not ask for alternative opinions. This is indicated by the verbal confirmation: “well that is that (.) that works (.)”. Being rhetorically symbolic is a manner in which he rules different alternatives out. This is supported by the manner in which he immediately takes his eyes off the others in order to continue. He has a look, as if saying: “This is fair enough, isn’t it?” However, none of the attendees notices this symbolic gesture. All but Erkki are still captured by the demonstration prototype. This gesture contrasts sharply with the others immersed in the demonstration. This implies a sharp contradiction: the others are not in line with the decision or they are still unsure of it. As this ‘waltz’ comes to an end, Jouni commits to a symbolic and practical act: He turns the page in his paper documentation. Thus, he re-orientates himself to a next task. He glances at the client participants, which also indicates his re-orientation to the next task to be discussed.

Exerting power

Immediately after his symbolic act, Timo begins with the new task. During this time, the dance in which he brings the others is in the rhetoric mode. I call this dance *forced acceptance*. Timo is not trying to establish a reciprocal process for the negotiation. Timo starts describing the new task verbally and rhetorically. Even though he frequently uses the filler “er”, thus constructing an unsure image of himself, he still seems to hold sway over the others **[turn 8]**. This is in contrast to the others who are not reacting to Timos’s rhetorical acts.

The others are still under the spell of the prototype. Jouni turns to Timo in order to understand his speech before the demonstration. Timo has changed the topic. His monologue becomes an initiative for Jouni to start the demonstration. Timo discusses updating the funding proposal: “Marja or somebody wants to er update the funding proposal” **[turn 8]**. As he mentions ”via the list screen” with a break of 4.5 seconds, it becomes clear for Jouni that the step that Timo verbally and rhetorically shared, should be demonstrated. Timo seems to use this break to show he is waiting for the demonstrated step. Jouni opens the correct screen even without an explicit request to do so. This reflects the existing and unfolding power structure. For some reason, the others seem to be silently accepting this shift of initiative. During this break of 4.5 seconds, Jouni is expected to demonstrate the step. This is indicated by how Timo waits on Jouni’s response, being all eyes. He rests quite self-confidently back in his chair, hands wide away from each other, as if creating an image of himself as a kind of authority. Jouni accepts the invitation to this rhetorical dance. He grasps the mouse and echoes what was implicitly expected. Keijo is immersed in what happens. Instead, Pekka, Erkki and Asko suddenly fidget around. Soon, Pekka and Asko are browsing pages of the paper-based documentation, as if seeking to find something.

Immediately after he is finished with his wrist watch, Erkki rests back in his chair. He remains as a passive and disengaged attendee. After a break of 4.5 seconds, Timo accepts the step he verbally constructed by neutrally stating: “there” **[turn 8]**. He uses talking aloud as a strategy to share explicitly his decision with the others. In this way, he exerts power over the others. The utterance “there” serves as a trigger for Asko and Pekka. They immediately react by glancing at the demonstration prototype. They may aim at getting a grasp of what Timo is talking about. In doing so, they seek to find a focus of Timo’s monologue. They try to succeed in it by comparing the demonstration to their printouts. Timo still goes on to carry this waltz by uttering: “chooses the organization (.) and due i-((tem))”.

Interrupting and accounting

Jouni is the only person to accept the invitation to this dance. Now Keijo commits to an intervention. Keijo breaks in on Timo's speech by his statement overlapping that of Timo's: "[Wa:ait now when first we (.)" **[turn 9]**. Timo is forced to cease talking. After the intervention, Pekka takes his eyes off his document in order to turn to look at the demonstration. Nevertheless Keijo is not allowed to proceed without an account. As he interrupts, he becomes accountable. Timo's quick and sharp glance at Keijo serves as a signal for Keijo to give an account. Keijo pleads as follows: "we go there so that we will not go so fast" **[turn 9]**, making it clear that he has lost the point. By turning to the demonstration, Pekka also indicates implicitly that he has also lost the subject. By contrast, Asko is still browsing through his papers. In interrupting Timo, Keijo points his finger at the demonstration prototype. This seems to mean there is something wrong with the demonstration. Thus, he rejects the dance *forced acceptance*. Timo accepts the offered account with an astonished utterance: "Aha" **[turn 10]**. Jouni also accepts this intervention: he responsively and empathetically makes a suggestion: "Do we close down this one?" **[turn 11]**. Keijo is satisfied with the suggestion and responds positively: "Yah" **[turn 12]**.

DISCUSSION

What does it mean to employ the demonstration prototype responsively and rhetorically? Both the representation, the manner in which it is used, and who has the control or initiative have profound implications for how successful a negotiation is. Both episodes are characterized in this respect in Table 1. The implications of these locally unfolding interaction modes on the negotiation of requirements are then outlined.

Table 1: Nature of interaction during the episodes.

Episode I		**Episode II**	
		Before intervention:	After intervention:
-Responsive collaboration -Common object and participation framework exist -Reciprocal control	Þ	-Rhetorical persuasion -Common object and participation framework → Individual participation frameworks -Control by one person	-Neither responsive nor rhetorical -Individual participation frameworks -Control by no one

Representation as a prop in establishing and maintaining rhetorical or responsive action

To be responsive in negotiations, the negotiators need to create a common object (i.e. a common focus) as a condition for successful interaction. To maintain smooth interaction, it is also essential to create a common participation framework [15]. The interaction space within the participation framework created by the external shared model [15] (a representation if you like) appears to be focal in shaping successful interaction. The common artifacts allow *the represented* to be negotiated [18].

In episode I, the demonstration prototype, a common object, was projected onto the silver screen in front of the room. Jouni seemed to create this common focus on which the participants' task orientation was concentrated. During this episode, both the participation framework and interaction space was created. The common task orientation was, in turn, bodily maintained along with the clear eye contact with the demonstration. Wilson et al. [28] point out that the user attitudes towards the use of whiteboard and paper prototypes as common artifacts depend on the person. In this case, everybody, except for Erkki, accepted tacitly the demonstration prototype as a common object. Erkki disengaged himself. No doubt a person may choose the state of inaction as negotiating [16]. In the course of their responsive action, in episode I, the participants communicated via the demonstration prototype (the screens/task sequence) as a boundary object that let participants maintain the common identity and to approach *the represented* from the perspectives that make sense to single individuals. If participants sit near each other, they can successfully create an interaction space [15]. In the case that I have studied, it does not matter, if the participants are sitting apart from each other. This is because the limitations of physical space are overcome by means of the projected demonstration serving as a common artifact enabling implicit communication [18]. Concrete terms enabled Jouni to follow the discussion and demonstrate the steps. The others sustained the task orientation by verbally repeating the demonstrated steps. Negotiation was based on the reciprocal and responsive action. Basically, everyone who wants to join in on the discussion is offered, at least, a chance to do so. The use of the demonstration prototype effectively encouraged the others to join in this unfolding participation framework. There were no apparent communication problems at all. This is, however, true only for those who really participated and did it actively. The perspectives were shared by references to the demonstration prototype. As a consequence, the interaction was rendered smooth.

In a study by Trigg, Bødker, and Grønbæk [26], control is given to the users by means of a common artifact. By contrast, in episode I, the representation type and control became locally defined as common resources in the course of interaction. Madsen [13] has noted that, for example, documents from the work practice, if used as common objects, may trigger active participation. In episode I, the demonstration prototype encouraged only some of the participants to be active. No one was explicitly exerting power over the other. In a situation like this, it is more about who is taking part actively. Although the participation framework was created, it is only Timo, Keijo and the designers who were actively taking part. This implies the existing power structure that is reproduced by managerial 'muscles' or the technology that was introduced.

On the other hand, we need to ask whether a prototype can be too complete, 'blinding' the participants. We can ask whether a demonstration drives the discussion too much. Low-fidelity representations are shown to create lower thresholds for users to interact with the implementation [5]. According to Shotter [21, p. 180], if responsive, a person reacts in the form of affirmation, disagreement, puzzlement, elaboration, application, etc. In episode I, the implementation was in effect not questioned. It was accepted as it is. Related to why the demonstration, however, was later rejected, Jouni answered as follows:

> "It suddenly crossed my mind that the participants became too glued to the demo. As a consequence, this could delimit the amount of options to be discussed. At the same time, I was reflecting, and terrified of, the thought that whether we implement the application based on this demo ;)" [sic].

Supported by Jouni's view, I conclude that although the common focus and participation framework were created by means of the demonstration, it was not encouraging the participants to embrace design options. In the testing phase of the system, after one of the sessions (held on May 31, 2001), I came back to this theme. I wrote in my notebook:

> "As to the demonstration program, Jouni stresses that it shouldn't have been used to that extent. The demo was showing the route for discussions, maybe too much, as he suspects (...) He talks about having both tech and use cases. User interface, in turn, is at the other end of the line. He's making a fascinating cut-off. (...) As to doing things differently, Jouni says that he could have employed screens and use cases in tandem."

The control was moved from the collective to an individual (the Manager) on the quiet during episodes I and II. After becoming a 'rubber stamp' (i.e. accepting things as they are) at the end of episode I, Timo began to act like a person who wants to persuade the others to accept things as they are. The control and initiative was not only handed over to him, but he also seemed to keep it. Thus, he finally started exercising power. At the outset of this episode II, it is apparent that all but Erkki got stuck on the previous task orientation. As a consequence, Timo was offered a channel for persuasion. The high-fidelity prototype, a sort of 'lure', maintained the task orientation. Before the breakdown of the participation framework, Timo had an effortless task to enter this task orientation maintained by the shared common artifact. Even low-fidelity mock-ups may allow mutual disagreements to exist [3]. Timo rhetorically constructed his monologue, having no interest in responsive reactions. If being committed to a monologue, the authority is "deaf to the other's response" [1, p. 293]. Timo succeeded in engaging Jouni in his biased participation framework. Jouni's task was to render the rhetorical speech concrete. Hence, Jouni supported Timo, likely unconsciously, in the attempt to persuade the others to the managerial view. Bowers and Pycock [3] emphasize that resistance and arguments are rarely explicitly expressed but here, in episode II, there was even no indirect or implicit resistance. The exception, a brave one, is that by Keijo. He was forced to interrupt Timo with a direct utterance, if he wanted to succeed. In this case, the participation framework was subject to breakdown. As an indication, Asko and Pekka re-orientated themselves by turning to look at their paper documents. This created individual participation frameworks.

According to Timpka and Sjöberg [25], the voice of engineering is a powerful strategy with which to win arguments. It has the elusive vocabulary for outsiders. I use the term "the voice of management". It is natural that the manager exerts power over others, but in this case, the manager was not only using his speech to persuade but also other means he was offered in the local situation. One of those was an emerged communication channel. The others were not yielding [16], but they were yielded. Timo was not contending. Instead, he had already won the argument. It is difficult for the others to resist rhetorical acts like this. The only means for successfully breaking the rhetorical action is a direct intervention. However, an intervention in a situation like this always requires an "account" [7], justifying the act to which one is committed.

CONCLUSIONS

Rhetorical persuasion appeared to hinder successful requirements determination. The participants need to be able to maintain a responsive mode when interacting. In this study, some questions, however, arose. Why were the work practitioners passive? Why did the group fail to maintain responsiveness?

The prototype opened up the hidden channel for rhetorical purposes since it appeared to be 'blinding' the participants. Thus, a prototype does not create a democratic participation structure *inherently*, but it can be used to exert power, as well. The study implies that a common artifact should be like a sketch rather than a high-fidelity prototype. The latter may create a channel for exercising power.

In a more democratic user-centered dialogue the shift of control should be controlled in a way that the exercise of power can be mitigated. If control is freely established, it depends on the existing and naturally unfolding power of relationships on how the control shifts or moves (if at all).

According to Bowers and Pycock [3], reflexive participatory design is a potential way for involving users. The participants, in that case, are reflexive, that is, conscious of the means of their interaction. Power cannot be avoided [22]. Thus, we need methods that help being (self)-reflexive about the potential use of power. Each participant should be encouraged to participate, to be actively constructive, and to reflect on the continuously emerging power relationships. In this way, exercises of power could be curtailed and a responsive mode maintained. It is then a matter for some sort of a methodology to enable a participation structure like this.

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APPENDIX

Transcript symbols [29]:

.hh	= Audible inbreath
hh	= Audible outbreath
((aba))	= Double parentheses enclose transcriber's descriptions of non-speech sounds or other features of the talk or scene
(.), (1.0)	= Pause as untimed and timed (to the nearest tenth of a second)
aba-	= A sharp cutoff of speech
[aba	= The onset of overlapping talk
ABA	= Talk that is noticeably louder than surrounding talk
°aba°	= Talk that is noticeably more quiet than surrounding talk
>aba<	= Talk that is noticeably faster than surrounding talk
end of line=	
=start of line	= Latching (no interval) between utterances

Design is a Game: Developing Design Competence in a Game Setting

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INTRODUCTION

In this article we propose design games as a way of building design competence for design students as well as for practitioners. We report on four experiments in which game playing, game creation and game reflection has revealed a potential in developing design competence. We show how the use of games can contribute to talking about collaborative design processes, modelling design situations, exploring real life design and improving an existing design practice. Our findings are derived from both educational and industrial settings.

Keywords
Design games, Silent Game, participatory design, design representations, design teaching

INTRODUCTION

In participatory design the ability to organize collaboration is a central part of the design competence – along with the ability to envision futures and create new artefacts. This poses a particular challenge for design teaching. Learning to establish social interaction between stakeholders in a design process (e.g. users and developers) requires cycles of experimentation and reflection. Traditional project exercises for students typically provide one-shot opportunities only to organise for instance user workshops, field visits, and meetings with companies. In search of alternative ways of developing collaborative design skills, we have explored various forms of board games, because they can establish a frame for experimentation and learning about design collaboration.

The work presented here is an action research effort, i.e. we have developed our understanding of games in design through a series of interventions in both student and practitioner settings.

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TEACHING DESIGN

When teaching design a few years ago we – like most other design educators – introduced students to design literature and organised project-type design exercises. Our ideal was to nourish a ‘reflective practicum’ [7] for newcomers to experience design practice from the front row.

In spite of 7good intentions, we discovered that this way of preparing students for the social process of designing misfired in several ways.

- Design literature encourages students to understand design in theory - not to practice design.

Oral or written attempts to capture the learning process through which methods become part of a design process most often fail because they depend on a de-contextualised construction of a social practice, which is highly situation specific. They become guidelines or recipes of idealised design practice.

- Design project exercises offer students an opportunity to experience design methods in action – not to build a repertoire of design practices.

Often students are eager to try out as many participatory design methods as possible in a project setting. Having little prior experience with real life design situations the students will try very hard to stick to their predetermined method or recipe instead of exploring the opportunities of the specific situation at hand. Indeed the students learn by doing, but they are often left with a rather inexpedient frustration of “methods that don’t work”, as they have no opportunity to reach a level of equilibrium.

Three major concerns arise from relying solely on project-based education in training novice designers. First, students are unable to move beyond the initial fascination of the methods being introduced to them in the design course. Instead of solving real life problems by interacting with the design situation, they tend to focus on fulfilling the requirements of a particular method.

Second, to catalyse design competence, project based education requires a level of experience, which students don't yet have. The learning process of project-based education is exposing students to new situations and thereby challenges their existing repertoire of 'appropriate' design moves. When novice designers with no prior experience participate in this learning process, they cannot assess the value of design methods, nor can they identify their relevance to the design situation at hand.

Third, project-based education in itself is insufficient to train the reflection activities necessary for the learning-in-action of a design competence. It is essential for students to experiment with ways of carrying out off-loop reflections for forming and consolidating a particular way of working as part of their (collective) repertoire of design practices [7].

Facing these challenges we started experimenting with a design curriculum based on a new design didactic of which design games are an important element.

WHAT IS SKILFUL PARTICIPATORY DESIGN?

In our understanding, design is the creation of new meaningful artefacts in respect for an existing practice. Design is not just the ability to generate solutions to a yet unsolved problem but rather a way of exploring potentiality or development areas in use context. Hence, there is no right or wrong in the process of designing. Design is an inherent endeavour towards "doing better" [2].

When conveying the competence of designing we cannot limit our attention to what a single designer does to a static artefact. We must take into account two important issues (following Harbraken [4]):

First, design regularly involves a variety of different competencies. The artefact to be made is designed in a process of collaboration and negotiation among designers with different motives, professions and visions. To some extent it is even customary to involve participants from use context in the design process, which makes the process of social interaction even more opaque and vague. Design is a social activity that takes place among people who negotiate. The design process is an ecology of participation, communicating both internally and with the rest of the world, depending upon the socially constructed values participants assign each other.

Second, artefacts change continuously. Artefacts are never finished and we keep designing or re-designing them in order to meet new demands from use practice and to benefit from new technologies. Most design work relates to organizations and existing tools that must be added to or redesigned. A change in use practice causes a new demand for more appropriate artefacts to cope with the new situation. Designing technology for people and places always alters a larger object than the artefact itself. It alters the practice, which it eventually becomes a part of.

In our effort to develop a design curriculum that to a larger extent faces the challenges of PD practice, we experimented with games as a metaphor for design collaboration. Previously explorative studies have emphasised PD work as play. Ehn and Sjögren (1991) developed this concept both theoretically and methodologically. Organisational design games were seen as vehicle for 'designing-by-playing'. They used games as a way of involving participants in the process of envisioning and experiencing future work situations in fun and liberating ways [3]. Muller, Wildman and White (1994) have shown through their research, that games are helpful, because they provide a familiar, relaxed and relatively egalitarian atmosphere within which the stakeholders combine their diverse backgrounds to develop new solutions and to meet one another's needs [5]. We acknowledge the work of these studies but we also see a different potential in game playing as yet uncovered. In the following cases we try to explore game playing as a way of building design competence in several ways. We will show how the use of games can contribute to establishing a collaborative design vocabulary, to modelling design situations, to exploring real life design, and finally to improving an existing design practice.

VERBALISING DESIGN

A *Concept Design Game* in the sense of Harbraken (1987) is a board game that models certain aspects of the design process. It has bricks and board, roles and rules, but it differs from ordinary games by having no elements of competition. The game is not about winning; it is a reflective setting for exploring design moves and strategies. We use the Silent Game [4] in student design training to establish a vocabulary for talking about collaborative design practice.

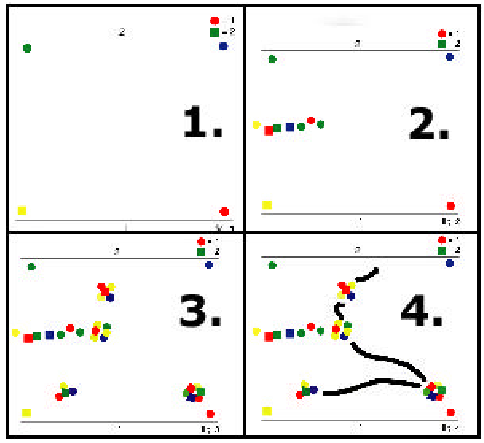
The Silent Game is played by two players (e.g. lead designer and assistant) and an observer. The players use wooden (or Lego) bricks to collaboratively build a design. No talking is allowed during the game.

Player 1 starts the game by placing one or two pieces on the game board to express a personal design idea. Interpreting player 1's move, player 2 makes her move by placing a piece on the game board, in a way that it relates to player 1's move. If player 2 gets the idea, player 1 can expand the idea; if not, she can emphasize the intention in her subsequent moves. Player 2 can typically play along obediently, try to expand the idea, or even try to obstruct it. The game ends when the observer sees no progression in the game. Then a debriefing session starts with the observer's account of the game followed by player 2's and finally player 1's reflections.

The Silent Game is a way of establishing a 'game vocabulary' in a late Wittgensteinian sense [8]: Moving bricks on the game board is a way of establishing a language game with brick moves as acts of speech. (The success of a speech act is determined by whether the recipient understands the communication - not by the media in which the communications takes place.) By playing language games such as the Silent Game, the students get familiar with social aspects of designing: team roles, project constraints, design moves, negotiation strategies, rules to follow, and the inner logic of turn-taking.

The Silent Game

Three students at the Department of Information Science, University of Aarhus, documented the following example of a Silent Game. The log is the students' actual account of the game.



The Silent Game: Two players collaboratively build a structure using coloured wooden bricks

Observer: "The first player started out by placing three blocks of different colours in three corners of what had, by convention in earlier games, contained the playing field. This in such a manner as to invite the second player to place the fourth block of the yet unused colour in the fourth corner. Second player responded by doing just that, and by that ended his turn. **(1)**.

The first player went on to break the defined pattern by placing three blocks on the field in no particular order. Second player responded by placing three blocks next to the newly placed blocks **(2)**.

The first player then placed a single block outside of the frame, and the second player built a small tower. The idea of towers occupied the next phase of the game and resulted in four towers **(3)**.

The final portion of the game consisted of building connections between the towers. **(4)**."

Player 2: "I start out by deciding to follow the strategy of submission, meaning that I will try to follow 'the orders' from player 1. In the hectic end game, no one noticed that the initial frame was used again in the new constructions. Thus we end by the ultimate resetting of the frame for the game. As player 2, I go through the following phase: 1) Determine strategy, 2) Frustration, 3) Change of strategy, 4) Initiative, 5) Cooperation, 6) Satisfying result."

Player 1: "My intention with the game was to create a kind of "meta-game", in which I could test some ways of cooperating with player 2. I had no construction plans, but wanted to create a dynamic and productive game."

Observer: "For me the fascination in this game lies in the implicit communication, that got established between the two players with so little effort, and then didn't seem to matter at all with respect to placing blocks. Instead the communication simply established a consensus that something was going to be built, and that the exact form didn't matter at all. The end-game seemed to indicate that both players were aware of the deadline implied by the diminished supply of blocks, and both strived to complete the work."

Through this game the students learned that it is indeed possible to enter a mode of design collaboration, even though you do not know – or agree upon – the goal. And that following the lead of the other team members may not be the most constructive strategy.

Our experiments show that the Silent Game is an inspiring interactive frame for training collaborative design processes and reflective design practice in the Schön tradition.

MODELLING DESIGN PRACTICE

Once students are familiar with the Silent Game, we start modifying the rules to simulate real-life collaborative design situations: (What if there are three players? If players can move no more than one piece at a time?). The restricted communication channel of the Silent Game ensures strong focus on the collaborative aspects of design. Students learn to use board games as a test bed for exploring social settings [1]. Then we encourage students to begin creating their own games to simulate a particular design situation they want to study. Examples of the situations we have worked with are 'A newcomer in the design team'; 'The design team acting in the larger organisation'; and 'Coordinating design across several product divisions'.

We ask the students to put a real effort into designing the materials of their game: the board and pieces, the box with advertisements, and a self-explanatory user guide. And to produce not just one prototype, but a small 'manufacturing series' of 4 games. In the design critique session, the students get the chance to try out their games with invited

The Product Value Game: Two players negotiate silently which values they want to attribute to their product using colourful picture cards.

guests. The game creation in itself becomes a design process.

The Product Value Game

One group of design students at the Mads Clausen Institute in Sønderborg created a game for exploring the situation in which team members verbalise and negotiate the 'soft' values they want to realise in their product. The students designed two identical sets of 24 picture cards with colourful images, which can be used to attribute values to a product (strong, fast, organic, easy, etc.). Like the Silent Game, this game has two players and is played in silence.

From a stack of 'product cards', one of the players picks a product for the first round, e.g. a cellular phone. Each player then selects 5 picture cards to represent the values they would like to see in a cellular phone design. Now the players compare their selections. If they differ, they take turns suggesting replacement images to negotiate a shared value set. The game ends, when the selections of 5 cards are identical for both players. In the debriefing session, the players try to verbalise their understanding of the product values and reflect on the negotiation process. Being forced to negotiate pictures without speaking, means that the players develop a very precise understanding of what values the images correspond to, before they put words on them.

One of the students actually tried to use this game in a later project, where he was in a team with two engineering students. The game proved to be very successful for verbalising the often-unsaid product values and for exploring the process of value negotiation between team members.

Traces of good design games

In the Sønderborg design class, we asked the students to evaluate their own design process and to note down what they thought they had learned from the game design project. One Chinese student, for instance, wrote, *"Do something"* on one of his post-it notes. With this he meant that in design – just like in games – you've got to make moves yourself; you can't just sit back and wait for the other team members to take initiative. To him – with his cultural background – this was quite an important point of learning.

We then structured the students' reflection statements using game terms. This experiment resulted in a challenging list of 'instructions' for a successful design game:

- The material (board and pieces) should be inspiring
- There should be rules to start the game, but they must not be rigid
- You should have the option of expanding your role
- You need to make bold moves
- Respectful turn-taking is crucial.

The students also formulated the qualities of a successful game: We play, because it is fun to play, because the game takes surprising turns of events, and because it is a challenge to bring the game to an end.

It is evident from this list that the students have learned aspects of collaboration, which transfer easily to 'real' design.

EXPLORING REAL LIFE DESIGN

Can games help students explore what actually happens in real life situations? To acquire design competence requires hands-on experiences as well as conscientious off-loop reflection. Recently we were engaged in a game training session, which on one hand was an attempt to explore real life design situations and on the other hand an investigation into the potential of game construction. By experimenting with different kinds of games we discovered a potential in using games as a framework for off-loop peer-to-peer reflection and among students engaged in different design environments.

One particular episode in a design course in the Malmö Interaction Design programme illustrates the fruitfulness of practicing off-loop reflections in a game setting. Three students from Malmö and one from Aarhus designed a virtual game for sharing experiences about communication in larger organisations. All students were engaged in real life design projects at the time of the experiment. In class they voiced the same frustrating challenge in their work in industry: The students felt that their respective design project teams (in the companies) had a hard time conveying design visions to the product development departments.

The Vision Communication Game

Inspired by different kinds of design games in the course, the students created a design game as a test bed for exploring how small design teams could overcome the challenges of communicating design ideas to development departments.

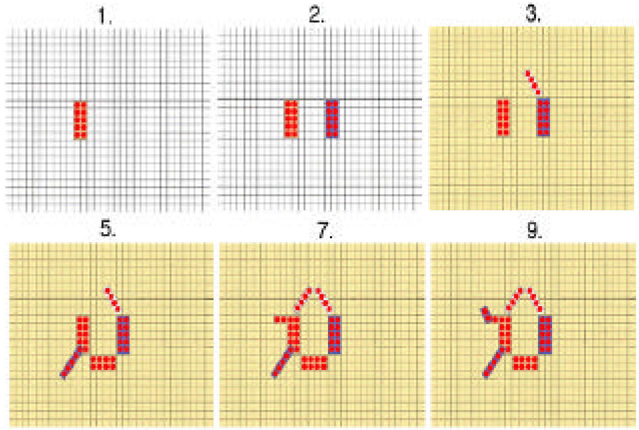
The Vision Communication game involved four participants: Two design team members (designers), a managing designer (the project manager), and a game master (the product development department). Using virtual Lego bricks, the designers developed a design object which was yet unknown to the game master. The designers would succeed in their assignment if the game master within the limit of 20 design moves would be able to guess what this object was. If the game master was unable to identify progression or patterns in the design moves, she had the authority to terminate the game. The game was carried out as a virtual game using nonverbal e-mail communication. In a graphic design programme an 8x8 cm grid acted as game board while different predefined layers were manipulated as virtual game bricks.

While the students were playing their first game, the game master, Susan, was called away to a different design assignment abroad. The players continued undauntedly designing their virtual object, which in this case was a frog.

One week later when Susan returned to the design studio, nine design moves had been executed. Eager to learn what had happened in the design game, she read the pictures in the nine emails in her mailbox. Overwhelmed by the many emails and frustrated by her lack of touch, she decided to terminate the game. Her e-mail to the three players read: "Sorry guys, but my travel has made this game-experiment a bit confusing. I suggest we terminate this game." The three players responded with frustration. To them they had played a progressive and well-documented game visualizing in each move that this object eventually was a frog. Moreover Susan had terminated a research project of essential value to all its participants.

The students brought this game to the design class. Reflecting on the progression and misfortune of the design game, they suddenly discovered an equivalence between their game experiences and their real life design challenge. Susan's careless game termination was just as inconsiderate as managers' lack of interest towards the findings of their respective design teams. Indeed the students had developed a game with a match to their own real life design experience.

When encouraged to analyse this particular game, one of the students suggested that



The Vision Communication Game: Players collaborate to create an object via e-mail. This frog was built in moves between three participants.

> "An integrated and important part of developing state of the art interaction design is continuously involving stakeholders in the research progress."

In the Vision Communication Game the students discovered that the design team itself had to take action towards securing continuous interaction with the product development department. In subsequent games the students experimented with several ways of keeping an ongoing communication with the game master and thereby exploring different methods for collaborating.

To experienced designers the process of communicating new design ideas to stakeholders all through the entire design process would sound trivial. One could accuse the teacher of not sharing this common knowledge of design practice with his students. But design competence is acquired neither in an all-scholastic environment nor in an all apprenticeship practice. Novice designers must - in a process of what Schön calls reflection-on-action [7] - frame the situation at hand by themselves and take action according to their design repertoire. We will argue that this process of framing a design situation and subsequently applying off-loop reflections in a game environment expands the student's design repertoire.

DEVELOPING DESIGN PRACTICE IN INDUSTRY

Are games simply teaching tools for novice designers, or can they also help design practitioners reflect and improve their design practice?

Recently, one of the authors was asked to facilitate a workshop on future usability practice at a Danish software company. Due to strategic changes within the company organization, the internal usability group was faced with the challenge of turning its activities into an independent business, catering not only to internal departments, but also attracting external clients. Triggered by recent usability disasters in public Danish software projects, and inspired by the work of Jacob Nielsen (1994 [6]), management had identified usability consultancy as a promising new business opportunity for the company.

The usability group was transferred from the internal service department to a product development unit and lost its corporate financing. Thus the group was forced to change its explorative, research-oriented practice and develop a more promotion minded approach to usability work.

At the time of the workshop, the usability group had one year of experience in its new organisational position. The group had already attracted several external business clients – much to the satisfaction of management. However, members of the usability group expressed discomfort with their new work practice. The workshop was an introspective session for the group, in which game playing served as a framework for exploring new practices of design collaboration.

Through the first two hours of the workshop the participants played the Silent Game to get familiar with game terms. The participants slowly pushed the games from straightforward product oriented design games to more complicated process oriented collaborative challenges. For instance, in their first game participants designed a multi-coloured flower, in the second game they modelled an urban environment.

Then, when asked to verbalise what they considered major challenges in their new work practice, the participants identified five questions:

> "(1) How do we engage external software developers more actively in our usability projects?
> (2) Why do we document our usability projects even though we always start from scratch?
> (3) How do we improve our process competence when we have no means for team training?
> (4) How do we sell usability services to clients who are black boxed to resent usability practice?
> (5) How can we in a more sufficient way share experiences within the usability group?"

After intensive discussions the participants chose the question of selling unknown services as the core challenge.

In an effort to identify exactly how to facilitate the assignment of creating a 'learn to sell usability services to clients black boxed to resent usability practice' game, we asked for an account of their shared interpretation of this particular challenge. The group stated their client's motives as unclear and sometimes even unaware of the entire notion of usability. In their uncertainty, clients turned to 'reliable' information channels such as management or programmer magazines, which in a common manner introduced the concept of usability *tests*. Some clients referred to Jacob Nielsen's 'Usability Engineering' [6] emphasizing usability *testing* as the core of usability practice.

Most frequently the usability group was asked to do a traditional usability test conducted in the laboratory, *testing* only the screen interface of a future software application. However, the group identified as their main asset the practice of participatory design and ethnographic field studies. The group's understanding of usability was not limited to GUI design, but included studies of practices that the artefact was a part of. When clients asked for a usability test, the group would try to explain the limitations of traditional usability testing and then convince the client to spend additional costs on the more labour-intensive usability *studies*. The group was able to give a rigid and well-articulated version of this particular challenge. We got the impression that this topic was frequently discussed in the group and hereby the challenge was a well-integrated part of their shared bias. Therefore we encouraged the group to bring forward associations or analogue situations as a framework for sketching the game of 'miscommunication with clients'.

During the discussions, one of the participants suggested the game of 'Sink the Ships'[1] as a metaphor. He pointed out a number of analogies between the board game and their own situation.

The players in Sink the Ships cannot see the game field of the other player. In client negotiations, the usability group tries to detect the intentions of clients who are unable to articulate their wants. And clients are on the other hand unfamiliar with recent usability practices.

A player in Sink the Ships only has a certain number of chances to 'hit' the targets without knowing exactly which strategy to choose. The usability group usually brings forward three different offers on a certain usability service. If even the lowest offer is too expensive, the clients go elsewhere to purchase the service.

Communication in Sink the Ships is reduced to a very formal and well-defined language in respect to turn taking, gestures and time of response. For usability consultancy, the clients mostly expect traditional business conventions: The customer sets the demands and the vendor fulfils these needs unconditionally. It is costly and risky to engage in discussions of a customer's actual needs before a contract is signed.

The metaphor animated the group to talk about their challenge in constructive manners and to develop their own

[1] Sink the Ships is a classic two-player game of naval combat. The opponents start the game with five ships each on a hidden grid board. The objective of the game is to sink the opponent's ships before he sinks yours. Each has a set number of cannonballs to fire at the other. Using strategy and a bit of luck, sink all of your opponent's ships first to win the game.

game to explore options. The usability group started to create a board with two 'private' areas separated by a wall (box file). The discussions were carried out on two levels: The participants suggested different objects and gestures in the game frame, but the arguments for using these objects and gestures were taken from their real life experiences of client negotiations.

The Client Negotiation Game

In the end, the group designed a game that involved three player roles: the client, the usability consultant, and the end-user as game-master.

The rules of the game were as follows:

1. The client makes a written demand for a particular object that the usability consultant models with bricks. The design assignment is unknown to the end-user.
2. Having built the assignment on his/her private area of the game board, the consultant states an offer on the model explaining how many (and which kind of) bricks he/she has used.
3. Now the client models the same object on his private area of the game board using the same amount of bricks as the usability consultant (or less).
4. The two participants negotiate in turn which bricks are necessary and which can be left out. Each participant can make two propositions. The objects are still invisible to the other participant.
5. The players succeed if the end-user – now entering the game - can identify the object of the usability consultant.

The usability group managed to articulate and reframe their conception of client relations by using bricks, roles and game rules. By playing their own game, the usability specialist gained new insight about the difficulties of bridging customers' wants and usability know-how.

Our experiences from this software company suggest that it is very fruitful to explore future design moves in a game setting. Game construction and game reflection can work as a test bed for off-loop reflection in a design project.

LESSONS LEARNED

Although our experience is limited to three years of study, we see games as a particularly appropriate environment for participatory design practice training. The game frame encourages participants to pay attention to the social and communicative processes of design. Conducting participatory design is indeed a process of understanding and supporting collaboration and interaction between participants in the process of designing new artefacts.

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Extreme Participation – Moving Extreme Programming Towards Participatory Design

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ABSTRACT

Extreme Programming (XP) is a lightweight software development methodology that has risen to prominence in the last few years. XP and Participatory Design are related in motivation and approach but complimentary in many ways. The authors believe that integrating some Participatory Design approaches into XP substantially improves XP and may even bring some advantages to Participatory Design. This paper summarises XP, compares the two approaches, outlines our experience with XP, draws out some problems with classic XP and suggests some modifications based on Participatory Design.

Keywords

Extreme Programming, User stories, Participatory Design

INTRODUCTION

Over the last few years a software engineering methodology, which has been breaking with several traditional paradigms, has emerged. *Extreme Programming (XP)* [2],[24] is based on four main values: *simplicity, communication, feedback* and *courage* and expresses the necessity to overcome rigid conventions that have accumulated within the area of software engineering over the last decades. It aims to make software development more flexible and focuses on highly flexible environments with quickly changing requirements.

From a participatory design point of view Extreme Programming is interesting for two reasons. First, Extreme Programming implements a highly user-centred approach. Users play a key role during the design process, specifying and designing the system in cooperation with system developers in a strongly iterative, prototype-based process.

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Second, several principles of Extreme Programming assist software developers in producing software in a manner that is suitable for a rapid iterative approach. Some principles for instance help developers to overcome "release fear" and to avoid descending into details without consulting the user.

Over the last year, our research project, Information Ecology, has performed a prototypical software development process using an Extreme Programming approach. Our aim was to perform a participatory design approach while focussing on joint code production and the management of a distributed developer team at the same time.

Throughout the process we identified several shortcomings of XP with regard to user participation. Based on these problems and general considerations on the similarities and differences of XP and other participatory design approaches we extended our XP approach in order to represent user contributions in a more complete manner.

Within this article we are going to address three main issues, specifically we will:

1. identify the similarities and differences between Extreme Programming and participatory design approaches. Although Extreme Programming is rooted in another research tradition there are several interesting resemblances. The comparison is a prerequisite for the modification of XP towards a more complete user participation.
2. consider which potential benefits the application of XP could have in the context of a participatory design process. The impact of code production on the whole design process has rarely been addressed within the field of participatory design. We will point out several aspects of XP that will help to perform an effective iterative prototyping approach.

3. describe the modifications to our XP approach showing a possible way to integrate XP and selected participatory design methods.

Overview

The XP process gives an overview of the XP methodology, its history and the challenge it poses to traditional software engineering.

Participatory Design and XP compares XP with several participatory design methodologies. It points out conceptual weaknesses of XP in the context of participatory design and identifies possible contributions of XP to a participatory design process deploying iterative prototyping.

Our System – The Social Portal describes the system we built and describes the original design process as a way of introducing our experience of XP and our motivations for modifying the process.

Problems And Extensions Of The XP Process focuses on the problems that we encountered during our design and suggests extensions to the XP process to overcome these problems and other conceptual weaknesses of XP.

A New Design Phase describes the new design phase we performed based on the modifications on the XP process.

The final chapter sums up the paper and describes our future research.

THE XP PROCESS

This section provides a high level description of the Extreme Programming (XP) methodology for developing software. Our description of XP is based primarily on [2] and [24]

Our intention is not to provide a complete description, but to provide a context for this paper by discussing some of the broader points. We begin by describing some of the philosophy and motivation for Extreme Programming. The next section provides a sketch of the XP development process. Finally, we contrast XP with more traditional software engineering approaches.

Goals and scope of XP (development for dynamic environments)

Extreme Values

One of the key slogans of Extreme Programming is to "embrace change". The four fundamental values of XP, simplicity, communication, feedback and courage, are principles to enable the team to be constantly in touch with and responsive to a changing environment. The source of the change is the constant contact with the user as their concept of the system requirements evolves. XP is designed so that the software can evolve to match the requirements.

Simplicity in XP has two aspects. First there is simplicity in the process itself. Having a simple process means that it is less work for the development team to maintain the practices of XP. Secondly there is simplicity in implementation. In more traditional software engineering emphasis is placed on writing code that is easily extensible to future requirements. Promoting simplicity first means that the resulting software is easy to understand and reduces the time spent on extensions that may never be needed.

XP emphasises strong principles of *communication* within the development team and also between the team and the user. Communication within the team is achieved through frequent planning and design meetings, through sharing around development tasks, and through short daily updates. In this way the knowledge of the system and an awareness of the development process is shared throughout the team. Communication with the users is represented by the role of a customer in the team. A delegate of the user community, which XP calls the *customer* has an active part in the requirements and design of the project. She works in a close relationship with the development team, and takes a major role in planning development.

Feedback at all levels is an integral part of XP. Extensive test suites provide feedback on the software code. Speed of development and the accuracy of project estimates are constantly reflected on and revised. The on-site user representative provides feedback on how well the requirements are fulfilled.

The fourth fundamental value of XP, *courage*, is a call to trust the process. Designing and implementing only the immediate requirements and not thinking about future “possibilities” requires courage from the development team. It also refers to the courage needed to revise existing work extensively in the face of new requirements.

A major feature of XP is the constant feedback and evaluation of the software by users. Having user representatives (customers) actively involved in generating the requirements of the system as well as being a part of the development and planning process results in a very dynamic environment. The customer's concept of the system is constantly revised as they have constant feedback from the implementation.

XP methodology consists of only a few rules and practices that involve little effort to developers. In contrast to many other methodologies, XP makes very minimal use of design documentation (for reasons that will become clear). This lightweight process means that the process can respond quickly to the evolving requirements.

Extreme History

The roots of Extreme Programming lie in the Smalltalk community. Kent Beck and Ward Cunningham originated research on more flexible and agile development methodologies in the late 80s. They refined their informal practise on many projects in the early 90s. A coherent XP process was first performed in 1996 when Kent Beck applied a combination of informal practices to a project at Daimler-Chrysler. Since then, many aspects of XP have been refined and the methodology is continuously evolving.

XP building blocks

This section gives an overview of how XP works. We approach this by sketching the planning and design process and then by explaining the roles of various actors in those processes.

XP is usually explained by describing the practices and rules that should be followed. These may be applied to a development process piecemeal to make it "more extreme". A team must implement most of the practices (there is active discussion about exactly which practices are in that set) before it can claim to be "doing XP".

We have avoided describing most of the practises in detail to keep the description reasonably concise.

Planning and Design

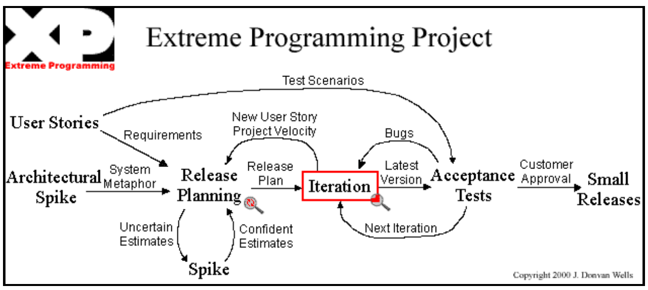

Figure 1 An overview of the XP planning and design process (from www.extremeprogramming.org)

At the heart of the XP planning process are *User Stories*. User Stories are two to three sentence informal descriptions of feature requests or desired working situations written by the customer. These short descriptions form the basis for planning development.

The development of a project is broken up into a series of small *releases*, further divided into *iterations*. An XP release cycle takes two to four months. Iterations take about one to four weeks each.

At the start of each release, the team produces a *release plan*. The release plan consists of the most important remaining User Stories. Selecting the most important User Stories for the release is the job of the customer. The developers provide time estimates for the Stories. For each release, the resources available and the quality of the product are fixed. The team, including the customer, decide on a fixed value for either the schedule or the scope of the project. They decide how long they will take or how much to do, but not both.

This collaborative planning process, with roles for both customer and developer and rules to follow is called *The Planning Game*. Customers and developers "play the game" to decide on what can be included in both releases and iterations.

During the planning game, users and designers select and prioritise user stories by different criteria. Users sort the stories by *value* into three piles:

1) vital for the system to function,
2) less essential, but of good value and
3) nice to have.

Designers sort stories by *risk* into three piles:

1) stories for which precise time estimates that can be provided,
2) stories that can be estimated reasonably well and
3) stories that can not be estimated at all [2].

The game enables the creation of the release plan that contains a candidate set of User Stories, which are both important and achievable in the time available.

At the beginning of each iteration, the customer chooses a smaller subset of those stories that could be achieved in the timescale of an iteration. This forms the *iteration plan*.

The high-level feature descriptions in the User Stories are broken down into specific engineering tasks. This is the point where most of the system design takes place. The existing design is modified to incorporate the extensions required by the iteration User Stories. Iterations are deliberately kept small so that the customer has frequent opportunities to evaluate and provide feedback.

After the completion of each iteration, the system is presented to the customer for evaluation. The customer checks to see that the User Stories selected for that iteration have been implemented satisfactorily. Any Stories that do not pass this testing are fed back into the process for selection in the next iteration.

At the conclusion of a release, as the name implies, a version of the system is released to the client organisation for feedback.

The Team Roles

XP makes five roles explicit within the team. Each team member may have more than one role and each role may have more than one person. The five roles are *programmer*, *customer*, *coach*, *tester* and *tracker*.

The *programmer's* primary role is, naturally, to program. To encourage quality and communication, XP defines some extensions to common programming practices. Firstly, *unit test suites* must be written before the code. This helps to assure quality and also communicates to other programmers the intention of the code. Secondly, programmers engage in *Pair Programming*; working in pairs, with one person looking over the other's shoulder. In this way the code undergoes a peer review as it is written. Possibly the most important benefit of pair programming is that, as pairs are swapped around, team members acquire knowledge of different parts of the system.

All phases of the XP process involve the *customer*. Initially, the customer writes the User Stories that are used in planning. Customers select the User Stories, which they wish to have implemented for the next system release. Next the customer collaborates in writing *acceptance tests*, which define the correct implementation of each User Story.

After the specified Stories have been implemented, customers take part in acceptance testing. Acceptance testing establishes whether the requirements have been accommodated by the system. In the event of customer dissatisfaction, the Story is placed back into the pool of User Stories available for selection in the next release so that the customer can prioritise its completion.

The customer's role is not limited to the planning and testing phases. User Stories are not intended as standalone descriptions of requirements, so the customer is in continuous communication with the developers during design and implementation to provide clarification of the stories.

The customer writes acceptance tests in collaboration with the *tester*. The tester is responsible for acceptance testing at the end of each iteration, running the unit test suites (usually daily) and communicating the results to the rest of the team

The *coach* is responsible for monitoring the team's use of XP. The coach needs to be aware of the process and be able to alter the process or the team if something is not working. Monitoring the process also means making sure that the fundamental values and the practices are being followed.

The *tracker* tracks the progress of the development, communicating the actual speed of development in relation to the estimated times on the User Stories. This information is fed back into the estimation process in future planning sessions. The tracker also produces forecasts of the release schedule during development.

Comparison with other software engineering methods

XP takes several practices from more traditional software engineering methodologies, and makes them "more extreme". More extreme methodologies are less formal and more tightly integrated into the implementation process. They are also performed only as they are needed and only as much as is needed for the immediate task.

Listed below are a number of traditional software engineering practices. We will discuss each of the practices in comparison to the corresponding practice in XP in order to give an overview of the XP philosophy in the light of proven techniques.

Requirements Analysis, Specification and Design

In contrast to the formal documentation and “contractual” communication between customers, designers and programmers in traditional software engineering, XP uses a continuous and informal “conversational” style of communication. The customer provides the designers with User Stories, which are deliberately vague. Designers, customers and programmers are in constant, continuous communication to resolve the details of what the customer requires.

The conversation works both ways. The system is designed and implemented in very small portions and then shown to the customer. The customer is able to modify and extend the requirements as their understanding of the system evolves. To allow quick response to the changing requirements, only a few User Stories are being implemented at one time and the design is as minimal as possible to just cover the current User Stories. The system design is then extended and refined as necessary to implement new requirements.

Code review.

In a traditional software engineering process, Code Reviews are conducted by one or more members of the development team. The reviewers read through the program code that has been written and refine it within the context of the project. The code is reviewed for structure, clarity and documentation as well as its adherence to project style guidelines and architecture. In addition to improving the quality of the code, code reviews also assist with training new team members into the team's coding style. Where the whole team performs the code review or the responsibility for review is moved around the team, it also serves to communicate knowledge of the project throughout the team.

The XP adaptation of code review is pair programming. The pair programming practice specifies that two of the developers work on the same coding task at the same time. One member of the pair types the code while the other sits behind them. Working in a pair provides the benefits of code review as the code is being written. The developer that is not typing is free to consider the context of the programming task. While appearing to be wasteful of programmers, the time is compensated for by the improved code quality at the time of writing. Pair programming has been experimentally validated as speeding up development time [7].

Testing

Traditionally, testing is a phase of development that is carried out after the main coding effort. Often the testing is carried out by a specialised tester who is not one of the programmers. Test cases are designed to cover as much of the logical functionality of the code as possible. Test cases are implemented to call the relevant sections of the code and check the output. Testing checks for logical errors in the code.

Testing in XP fills the same role as in other software engineering processes. The change that XP makes to testing is to require the programmers to write the tests before the code. Every time new code is written on the XP project, a corresponding test case must be written and implemented first. In this way the tests are written in an iterative fashion in parallel with the code by the person that is writing the code. The advantages of the XP methodology are that the practice is less onerous on the programmers, the tests are developed while the context is still fresh in the programmers mind, and there is constant feedback on the state of the code as tests can be run at any stage of development.

Integration Testing

A large system will usually be broken up into several sections for implementation. At some point these pieces have to be integrated to construct the whole system. Integration testing helps to check that all the pieces fit together as intended. The tests ensure that the system as a whole fits the specification. Often integration testing is the most time consuming stage of development.

XP practice is to continuously integrate. As a programmer makes a change to the code, it is integrated with the system daily. Integration and integration testing are incorporated into the development. This means that the testing is performed more often and because it's part of the development of a new feature, happens in the context of the addition. The integration is also performed in smaller chunks of effort.

In summary, XP is a lightweight process. In heavyweight methodologies, development is split into separate stages; requirements analysis, specification, design, coding, testing and integration testing. XP practice rolls all these into one, continuous stage. Everything is done only when it is needed.

The comparisons above do not show all of the differences between XP and more heavyweight software development processes. However, the major areas of software development are discussed to give an overview of the practical differences in Extreme Programming.

PARTICIPATORY DESIGN AND XP

On the first view, comparing XP with participatory design approaches seems like comparing apples with pears. XP is a software engineering methodology that is concerned with classical software-technological issues like code quality, interaction of developers, release planning, etc.

Participatory design is a research field, which has brought forth a huge variety of methods and approaches to realise and facilitate the integration of users into different levels of (software-) design processes. Most participatory design approaches are concerned with the process of design itself. They describe among other things, how design teams are set up, the different roles users play within the design process and the methods (e.g. scenarios [5],[1], mock-ups [9], games [10], ethnographic approaches [8], prototyping [4]) that are used to establish communication between different actors within the design process (e.g. users, designers, facilitators).

The field of software engineering on the whole, has been overall more reluctant to acknowledge the important role of the user within the design process. Even though the emergence of evolutionary and cyclic development methodologies like Floyd's STEPS model [14] and Boehm's spiral model [6] emphasized the strong necessity of user-participation, software engineering as a discipline has embraced user participation rather hesitantly. In many software engineering approaches the understanding of user participation is still often limited to requirement engineering, leaving users only a marginal role within the actual design process.

XP as a new software engineering approach has challenged several traditional paradigms of software design. One of these major changes is the strong focus on user participation. If we take a closer look, XP shares a number of similarities with participatory design approaches in general. It implements an iterative, prototype-based approach, integrating users on different levels of the design process. User representatives (customers) describe their requirements in a non-formal manner (user stories), decide about the implementation of components of the system (release and iteration planning) and judge whether certain aspects of the system have been implemented satisfactorily (acceptance test). The whole process is performed in a strongly iterative manner implementing rapid prototyping and continuous user involvement.

We see the emergence of XP as a possibility. Though incomplete with regard to user participation, XP offers insights about the way software-developers cooperate, that could help to further integrate the work of designers, users and software developers. The following chapter takes a closer look at the relationship between XP and participatory design approaches and will discuss their mutual influence. We are particularly interested in two issues:

1. What are the limitations of XP with regard to user participation? Can XP be enhanced to reflect a broader understanding of user participation based on participatory design approaches?
2. How does the process of software coding as it is performed within XP influence the design process as a whole? Which aspects of XP can be beneficial within a participatory design process?

In the following we will relate XP to some participatory design methodologies on a conceptual and methodological level, we will discuss shortcomings of XP in comparison to participatory design methodologies and discuss the question of what XP can offer within a participatory design process.

Conceptual and methodological similarities

We will consider four aspects of XP in the context of participatory design, user involvement, user stories, release and iteration planning and finally the XP prototyping approach.

In order to compare XP with participatory design approaches several notational differences need to be considered. XP originally represents users only in a representative manner within the customer role. We will henceforth use the term "user" if we talk about all potential users of a system in general and the term "customer" if we refer to particular aspects of the XP customer role. While participatory design approaches normally refer to the people driving the process as designers, XP talk about developers or programmers, due to the software engineering roots of this approach. Although representing different responsibilities the roles of the designer and the developer within the XP methodology intersect. In order to facilitate the comparison we will use the term "designer" from now on, unless we are referring to pure programming in which case we will use the term "developer".

User involvement

Within a participatory design process there are several levels of user participation and user selection. Depending on the size of the organisation, and the limitations of time and resources, the number of users participating actively or passively within the project can vary greatly. During workshops users representing different departments, or different organisational roles might be chosen. In workplace studies and ethnographic approaches the observer will choose work situations that are suitable to represent a wide range of the working context.

XP is rather unspecific about the selection process for the customer role. In general the customer is a user that is supposed to work in the area for which the software is developed. XP is not specific about the number of customers that are appropriate for a particular design process. One customer seems to be common in many projects, but any number of customers is possible. A certain shortcoming of XP is that it doesn't rule out the possibility that organisations nominate a person who might have a general view, but not a detailed view on particular working contexts, as the sole customer. In general, an appropriate user selection is necessary for both participatory design and XP approaches.

User stories

User stories are one of the main building blocks of the XP methodology. To revise their role, users (customers) describe in their own words "what they want the system to do" [24], with unstructured stories of about 3 sentences. User stories are often written down and represented on cards. They are used within the XP process in a threefold manner. First, the totality of user stories represents the informal, continually evolving user requirements for the system. Second, user stories are important elements used during the planning game. Developers estimate the amount of programming time for each release based on the user stories. And third, user stories are used within acceptance tests where users specify conditions to decide whether a user story has been implemented to their satisfaction.

User stories have similarities with several methods found in participatory design. Erickson uses "stories" as a means of communication between designers and users [12],[11]. Stories can be designer stories that reflect the designers experience from prior projects or people's stories that hold information about what people do and think about their work. In comparison to user stories as used in XP, people's stories in Erickson's sense are gathered and interpreted by designers.

Scenarios[1] are commonly used in participatory design [5]. They are similar to user stories in that they describe both situations of system use and system functionality in a non-formal manner. The main difference between scenarios and user stories is, that scenarios often describe a whole working situation covering several work practices and the use of a system within a work context. User stories in comparison are more fragmented and focus on singular use situations.

The process of creating and using user stories also differs. Scenarios are normally created in cooperation between designers and users and are often used in the initial stages of the design process. User stories are mainly utterances of users, created without direct contribution of designers. Consecutive versions of user stories are used during the whole lifecycle of the design process.

[1] we are not referring to scenarios as they are found in object-oriented design, e.g. [16]

Furthermore, a number of similarities between user stories and techniques used in object-oriented modelling can be identified. Methods like use cases, use case diagrams [16] and CRC cards [3], can represent information similar to user stories, though in a more structured manner. CRC cards may be used within an XP process to represent certain programming tasks among the system developers [24].

The use of user stories as a method of communication between users and designers has several potential benefits:

- User stories are small and easy to write. There are not many prerequisites for users to write user stories. User stories can cover several aspects of the development process, ranging from support for a particular working situation, to new necessary features or the improvement of existing functionality.
- User stories are a communication channel between particular users and designers. Designers can ask users for clarification if they do not understand the situation described in the user stories. Users and designers furthermore cooperate in order to define the acceptance test for a particular user story by which users define conditions that help designers to implement close to user needs.
- User stories are integrated within the design process. They are used during several levels (specification, release planning, iteration planning and acceptance tests) of the design process and fulfil multiple purposes.

XP does not articulate exactly how the designer and user interact in making design choices for the implementation of User Stories. Informal discussions before the customer prepares User Stories may be used to raise novel possibilities and discussion of the User Story to clarify its implementation during an iteration are both places in which designers may provide design options.

Although experienced designers may use the process to contribute options and facilitate innovative design, the lack of any practise to support this makes it an *ad hoc* modification. This may mean that less experienced or assertive designers may feel that the customer should carry out the task of specifying the system unaided. This in turn is likely to cause common problems like the “digitalisation of the status quo”

Planning game

As we discussed above, the planning game embodies the tension between what the customer wants and what the developers can deliver by allowing each of them to order the User Stories by value and risk respectively.

This sorting used in the planning game is similar to the use of CRC cards [3] and other card sorting games with the difference that users and designers use card sorting to express their different priorities for the development process.

Although the XP planning game utilizes several roles, it is rather different from games and role-playing found in participatory design (eg. [10], [18], [13]). Games, like the one described in [15] represent the environment in a more complex and playful way, letting the users explore working environments interactively. By contrast, the XP planning game serves only to resolve planning tensions.

Prototyping

The iterative prototyping approach of XP serves two main goals: first, to continuously involve users into the design and evaluation of the system, and second, to overcome release fear by releasing prototypes as early and as frequently as possible. This approach in general resembles many iterative design approaches found within participatory design. Users are participating on different levels of the design process.

Prototyping in XP can be classified as evolutionary prototyping (the system is evolving based on several iterations of a prototype) rather than throwaway or low-fidelity prototyping (a system that is only used for a limited time to demonstrate a particular state in the design process) [20], [22]. Although commitment to code quality enables developers to discard chunks of code during the design process this rarely relates to the prototype as a whole.

The role of the user-customer as part of the design team and the strong cooperation between designers and the user-customers meets Bødkers requirement of “cooperative prototyping” [4].

Summary

It is difficult to directly compare XP with participatory design methodologies in general, due to their different scopes. Still, there are similarities that are mainly grouped around the areas of prototyping and representation of user requirements. The XP prototyping approach is highly iterative and strongly influenced and driven by user decisions (based on User Stories and the planning game). User requirements are represented in a manner can be understood and shared by users in User Stories.

Although User Stories are the main means of communication between users and developers XP does not rule out the use of additional methods such as mockups or scenarios to further clarify requirements. Such methods are always meant to facilitate the communication, but never replace User Stories.

A potential danger of the XP process is the strong focus on selected user representation in comparison to a broader involvement of end-users. The process of selecting user representatives itself is not well specified within XP and is primarily based on the selection made by the customer-organisation

The following section will go into further detail regarding the shortcomings of XP in comparison to participatory design approaches.

Shortcomings of XP in the context of participatory design

Considering XP in the context of participatory design the following aspects of XP could potentially cause problems:

- XP does not support design in context. Users are represented by the customer role. The actual level of intersections between the user needs and the requirements the customer(s) formulate is not validated.
- Workplace studies are not a part of an XP process. XP does not provide the means to integrate results of workplace studies into the process.
- Customers are constantly exposed to the development process. It is likely that they start to identify with development-related problems, potentially losing their focus on user-related issues. This aspect in combination with the former points increases the danger of "tunnel vision" or "coming up with perfect technological solutions to the wrong set of work problems" [8, p. 93]
- Possibilities for the designer to influence the design process are only vaguely defined. On the one hand designers are not meant to interfere with the production of user stories. On the other hand designers lack appropriate practises to integrate design aspects into the process and to facilitate the customer role by providing different design options.

The use of XP within a participatory design process

Many participatory design approaches comprehensively revise the design process. Surprisingly though, the process of programming itself within the software design process is rarely looked at in this context. We are interested in the question, how the act of programming influences the design process and which aspects of coding have to be considered in general in order to support a participatory design process. Since XP is supposed to be suited to flexible, often changing environments, it needed to find ways the change code quickly and efficiently. XP implements 4 main rules to ensure this flexibility:

1. **Common code ownership**: Code belongs not to a single developer but to all developers in the team. This ensures that code is produced in a comprehensible manner since all developers of a team have to potentially understand it. Comprehensibility makes it possible to change the code quickly even if the originator of the code is not available.
2. **Pair programming**: Pair programming is another step to ensure that the code is mutually understood by several developers and helps to ensure code quality.
3. **Commitment to code quality**: XP requires a high level of code quality. Sound solutions that solve a problem in an aesthetic manner (in the sense of elegant logic rather than an attractive user interface) are preferred to "quick hacks". This rule does not conflict with the following one, since good solutions are rarely big or complex.
4. **Do the simplest thing possible**: Developers are meant to start with small and simple solutions that solve the problems that the current iteration raises. This rule contrasts with approaches that start with huge conceptual models and architectures and often struggle to deal with the related complexity. In XP the complexity of an implementation can increase over several releases, but is always rooted in simpler approaches that have proven to work.

The above rules document a certain perspective on code production that can influence the whole design process positively. We see possible benefits of XP in three areas: *speed*, *strong iteration* and *code quality*.

Speed: Code that is easy to change enables developers to implement new requests quickly. In addition, features that did not pass the acceptance test can be discarded efficiently.

Strong Iteration: Rule No. 4 in particular in combination with the planning process helps developers to overcome "release fear". A prototype is presented to the users even though it has minor or major flaws. XP developers can produce systems in a strongly iterative manner with short cycles between releases. Consequently, users can access succeeding versions of prototypes quicker. A quick succession of prototypes ensures that the development process stays dynamic and helps to prevent developments into the wrong direction.

Code Quality: Potential user dissatisfaction is not only caused by the mismatch between user's needs and the systems functionality, but potentially also by faulty code that leads to errors. Pair programming and commitment to code quality lead to software that is less prone to errors and generally increases the utility of the software.

OUR SYSTEM - THE SOCIAL PORTAL

This section describes our initial experiences with XP which motivated our interest in modifying the process as stated in the literature [2]. We describe the system we were developing and our approach to designing it, the way we involved users using XP and some of our difficulties with the classic process.

The Idea Of A Social Portal

One of the goals of the Information Ecology project at DSTC is to enable software to better exploit the broad context (both within the computing environment and beyond it) of the execution of a user command. Although several kinds of context are initially appealing, we initially set out to study just one kind: the patterns in people's social interaction with each other.

Our initial approach was to gather that information by providing an application which supports communication with a list of contacts and use that as a way to capture information. To be a useful research tool, we needed an application which people will use for a significant proportion of their communication, therefore it had to:

- serve a known need
- be more effective than existing solutions
- be primarily web-based to minimise the barriers to adoption.

These criteria led us to the idea of a “social portal”.

Portal sites such as My Yahoo! or Lycos or My Netscape attempt to pull all information of interest to the user together in one place. This information is usually organised as channels of information on some topic. Users can typically personalise the channels they see in a portal. For example, users can choose to see channels from newswire services such as Reuters alongside stock portfolio channels, TV listing channels, horoscopes, weather, and so on.

The Social Portal allows portal-style presentation of information from social networks. Rather than solely relying on general channels that may meet the user's information needs, we built a system that also uses social context to recommend information.

Individuals can use the system to send messages to social contacts such as colleagues, friends and family. The receivers of this information can personalise the portal to see the contributions of their friends alongside traditional portal channels.

Initial implementation

The initial system was based on the common portal metaphor of an online newspaper. Rather than receiving news items from a wire service like Reuters in this newspaper, users would receive recommendations of web pages from other users. Like many online newspapers, the Social Portal organises items into channels, one channel for each topic contributed by a given user.

The reverse-side of this design is that each user can make up channels about topics they would typically share and send recommendations to friends or colleagues using these channels.

So, the initial version was based on these two basic notions: recommendations and channels.

Recommendations had a title, a URL (for the thing being recommended), a description and a sender and date. Users soon worked out that they could omit the URL and just use recommendations to send a text message as a news item.

Channels are a conduit from their sender to a group of receivers. Each channel associates a set of recommendations on a common topic (in the opinion of the sender) with a set of receivers.

Each receiver had a page consisting of all the channels they had been sent. They had the means to rearrange the order of the channels in a two-column layout.

Figure 2 The main page of the social portal

Original User Involvement - Simple Adaptation of XP

We choose XP as a development methodology for several reasons:

- Our programming resources were limited. As a research project we needed a methodology that supported the effective creation of subsequent prototypes at low cost.
- Our developer-base was distributed. Having developers in three different sites distributed over Australia increased the necessity to rely on a methodology that supported cooperation and a a shared process among developers.
- The user-base was distributed. We initially planned to deploy the system at different sites of our organisation and in the long term to make it available to a wider user community on the web. Some of the traditional styles of user involvement were not suited for such a setting. XP seemed to be flexible enough to be adapted for this task.

The goal of our project was to build an application that we could use to capture information about computer-mediated social interaction. We needed an application that a lot of people would use regularly, in place of their existing methods of sharing information through their social networks.

This goal is too broad and exploratory to be translated directly into the User Stories necessary to start the Extreme Programming process. Additionally, we wanted to collaborate with our user community to evolve the vision for a useful social portal system. However, the people who would use the software defined that user community. It did not exist without the software leaving us with a "bootstrap problem"

We overcame these problems in a number ways:

- **ad-hoc customers:** we convinced some members of our initial target deployment community to play the customer role in our design team
- **bootstrap version:** we synthesised an initial version of the system to stimulate User Stories from our customers

The initial target deployment group for the application was our own organisation. One customer was from our organisation's business development section, and one from another research project. Our *ad hoc* customers were asked to use our initial system and write User Stories about how they would like the system adapted.

PROBLEMS AND EXTENSIONS OF THE XP PROCESS

We encountered a number of problems during our initial design phase. Although the customers were satisfied with the system, other users found it difficult to use. It became apparent that the original XP process as we had performed it so far, was too focused on customers as user representatives. In order to overcome this problem and to adapt XP to a broader understanding of user participation we extended the XP process in several aspects. All of the modifications to the process are reflected in additional roles, which add different responsibilities to the design process. In the following we will describe the problems we encountered and the proposed solutions.

Lack of design in context

XP lacks an overall sense of *design in context*. The main reason for this is that the main communication channel for user requirements are user stories. Users might choose to describe working situations and their work context, but they might also be quite focused on pure system functionality. The methodology has no means to ensure that the working context is taken into account. In the sense of [18] it's located on the scale "users directly participate in design activity" but lacks the aspect of "designers participate in users world".

It is obvious that there is an abundance of methods within participatory design, concerned with the understanding of the context the user works in (ethnographic approaches, workplace studies, role-playing games, etc.) The question is how information that can be gathered by using one of these methods can be integrated into an XP process. How does information about the use context influence the XP based design process as a whole?

In order to answer this question we have to focus on the planning game, which is the central hub for how requirements are rolled into the XP process. As we have pointed out before users (customers) have a major influence during the planning game, deciding which aspects of the iterative prototype are supposed to be implemented. In order to introduce findings that have been gained by user-studies we had to introduce another role that represented these aspects during the planning game. Integrating results from user evaluation should also help to overcome the problem that arises when customers have been part of the design team for too long and become "professional customers". There is a potential danger that customers identify themselves with the design process so much that they increasingly loose track of problems and requirements that might be relevant for other users who are not involved in it.

We encountered this problem when we realized that, although the customers seemed to be content with the prototype at that stage, the system seemed to be increasingly difficult to use for new users. New users when confronted with the system reported an overall lack of guidance and help throughout the system. It became obvious that the original customers involved in the design process had become increasingly unaware of problems that new users might encounter. As a consequence these problems had a lower priority and were not addressed sufficiently within the design process.

In order to integrate information about working situations and users that were not represented within the process we did two things:

First, we opened up the process of writing user stories to the whole user community rather than the customers representing a small fraction of users. We provided an **electronic feedback** form that was part of our prototype and enabled users to write user stories whenever the encountered a problem or had a specific requirement. The gathered user stories were integrated into the design process and became part of the planning game. Electronic methods for gathering user feedback become increasingly important in environments where organisational structures become more flexible and works happens in an increasingly distributed manner (see e.g. design processes in networked or virtual organisations [23], [21])

Second we introduced a role called the **user-evaluation customer** to the planning game. The user-evaluation customer has the same rights and obligations as other customers during the planning game. He represents user requirements that have been gained by studying users in their work environment[2]. The results are broken down into

[2] In our design process the user-evaluation customer represented the result that had been gained by constructive-interaction sessions and new-user evaluations

user stories, that are merged with the pool of existing user stories. The user-evaluation customer is meant to represent the user-community based on the user-studies within the planning game. The negotiation between the user-evaluation customer and the user customers (or customers in traditional XP) ensures that different user needs are represented within the process.

Intelligibility of user stories

Another problem we encountered was the abundance of user stories. Since all users could contribute user stories electronically, the pool of user stories was growing rapidly after the first few iterations. While having a large variety of user requirements is desirable in general, we realised that customers became more and more overwhelmed with the amount of new user stories. Especially when new customers were integrated into the design process, they found it hard to gain an overview of the existing stories. To this point user stories had been loosely classified into categories and identical stories were merged.

In order to use user stories more effectively we introduced a **gardener role** into the XP process. The gardener's task was to maintain the user stories in several aspects. First, she was meant to keep the stories current. Since the prototype continuously evolved, several of the user stories expired or their focus changed. Second, she was supposed to clarify user stories with the user who has written the respective stories if the stories were difficult to understand for other customers. Third, user stories were merged or split under participation of the respective customers, if they were dealing with a very similar aspect or covering several aspects respectively. And last, the gardener could add additional material (e.g. paper-based mockup) to make user stories more intelligible to other customers. This procedure was performed in close relationship with the originator of the stories as well.

The overall aim for the gardener was to reduce the amount of user stories, to keep them well structured and current and to enhance their intelligibility. The gardener did not have an active role within the planning game. As an expert for the existing user stories she was present during the planning game, acting as a facilitator in order to clarify questions regarding user stories.

Design vision

The last role we introduced relates to the insufficient role of designers within XP processes. The strong role of customers during the planning game and their independence in writing user stories leads to a lack of possibilities for designers to present their suggestions and take an active part in the process. In order to overcome this problem we introduced a **design customer role**, which enabled designers to take an active role during the planning game. The design customer has equal rights and obligations to the other customers during the planning game. Design suggestions are introduced by designer stories which are written by designers. Similar to user-evaluation stories they are merged with the pool of existing user stories. Design customers negotiate during the planning game with customers and user-evaluation customers about which aspects of the iterative prototype are supposed to be implemented in the next iteration/ release.

Summary

The enhanced XP methodology as it is proposed here comprises three new roles, the user-evaluation customer, the design customer and the gardener. Users (via electronic feedback), user customers, user-evaluation customers and design customers all write User Stories. All roles acting during the planning game can choose the relevant stories freely from the resulting story pool.

A NEW DESIGN PHASE

In the following we describe how the modifications to our XP approach were implemented in our design process.

User evaluations

In order to integrate a wider user base into the design process we performed several user evaluations. The results were used by the *user-evaluation customer* within the design game to represent the needs of users who where not represented within the game. We performed two sets of user evaluations, evaluations of new users and evaluations of a broad user base using constructive interaction methods.

New-user evaluations

As we have pointed out before, new users encountered an increasing amount of problems during system use. In order to understand the related problems with this particular user group we performed user evaluations on 10 users who hadn't used the system before. We used thinking aloud [19] and semi-structured interview methods for the evaluations. Each user sat through a half hour session performing several tasks that became increasingly complex. The tasks reflected the functionality of the system. The users were asked to utter their thoughts during system use. Each session was followed by a semi-structured interview covering the usefulness of the system and particular problems that had been encountered during the preceding session. The sessions were videotaped, transcribed and analysed. The result covered a wide area of the system from lacking help functionalities to non-intuitive page design. The result were broken down and represented as separate user-stories.

Cooperative user evaluations

The second set of user evaluations was focussing on the

(cp. chapter User evaluations)

fact that the system was mainly used for cooperative purposes. The test setting reflected this by using "constructive interaction" as evaluation method. We employed Kahler's variety of constructive interaction CITeCS [17] since it strongly focuses on collaborative tasks. The user base was a cross-section of all users within our organisation including people from different departments (accounts, administration, research, training, etc.) and different use-experience. We performed five constructive interaction sessions followed by a semi-structured interview. All sessions were videotaped and transcribed. The results were treated the same way as the results from the new-user-evaluations and represented in user stories.

User-evaluation stories

The user-evaluation customer used the combined user stories from the new user evaluations and the constructive interaction sessions to represent particular user needs. The user-evaluation customer rated the user stories by relevance (how often did the problem/wish occur ?) and urgency (how pressing was the problem/wish ?).

The new planning game

Within our new planning game we had five different main roles:

- Two user customers as user representatives, who were the original customers from the prior design phase;
- One user-evaluation customer;
- One design customer;
- The gardener was present in order to help with questions regarding user stories, but had no influence on the decision process;
- The developer team.

The four customers negotiated which stories to focus on during the next iteration or release. The different types of stories (user stories, designer stories, user-evaluation stories) built a common pool for all customers to choose from. Customers selected user stories that were not necessarily their own stories and tried to build a consensus by identifying related problems and needs.

CONCLUSIONS AND FUTURE WORK

XP is an emerging new methodology that is likely to be used increasingly in software development projects over the next few years. We compared XP with participatory design approaches and pointed out, that XP has a limited conception of user participation. Although users play an important role during the design process, XP lacks means to integrate a wide range of users into the design process and to perform "design in context".

Based on our experiences with XP we enhanced the XP process with the intention to firstly open it for the application of participatory design methods and secondly prepare XP as a possible software development method that could be used within participatory design processes. The methodology was extended by several roles, which reflect problems that were motivated by conceptual comparison with participatory design approaches as well as by the results of our empirical studies.

The consideration of XP in the context of participatory design poses interesting questions regarding the relationship between participatory design and software engineering in general. We addressed a small range of questions such as :

- How far does the culture and attitude of programmers influence the whole design process?
- Which programming practices are beneficial for user-centred design process?

We identified aspects that speed up the design process allowing for more frequent prototyping (common code ownership, pair programming, etc.) as well as exposing developers to an ongoing communication with users. These practices seem to be steps in the right direction, although further research needs to be done in this field.

Our research project on social portals is ongoing. We are currently preparing a new release of our system intended to support applications in several organisations external to DSTC. The additional measures and roles by which we enhanced our process have proven to be beneficial so far. User-customers appreciated the increased intelligibility of user stories treated by the gardener and preliminary user-studies have shown that the system has become more usable for new users. Further research is necessary to explore the applicability and limits of an extended XP approach.

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Probing the Probes

'Inspiration is not the special property of an elite but can be found in everyone'

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ABSTRACT Ethnographic studies of technology have focused on trying to understand the socially organised, naturally occurring uses of technological artifacts in socio-technical systems. This paper describes the design work of two separate research groups utilising 'cultural probes' as a mode of participatory design for domestic settings. The first group created specially designed probes to analyse the motivations that shape home life, to inspire future designs. The second group used a cultural probe derivative as an adjunct to an ethnographic study of a sensitive 'home' setting – a sheltered housing complex – and used them for 'information' rather than 'inspiration'. The paper outlines an innovative evaluation of the production, use and methods that inform the use of probes for a participatory design and explore the ways in which cultural probes and probes hybrids might present alternative strategies for exploring 'sensitive' settings.

Keywords
Methodology, participatory design, cultural probes, domestic probes, ethnography, art and design, design practice, home, workplace.
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INTRODUCTION

In October 2000, the UK Engineering and Physical Sciences Research Council (EPSRC) launched the Equator IRC (Equator #1). The six-year programme is a collaborative venture spanning eight research partners[1] and multiple disciplines including computer science, electronics, social science, psychology, art, design and architecture.

Equator research groups are creating devices and software platforms to interweave the physical and the digital in new ways. Research groups are developing innovative methods for designing and evaluating these technologies. From the outset, the Equator programme has been committed to combining these technologies and methods in a series of large-scale 'collaborative' projects that directly engage users in the design process. In practice, this grounded approach has resulted in a series of practical evaluations that directly involve the participation of users through collaborations with museums, performance groups, community support groups, care organizations, schools and other user collectivities.

One of the fundamental challenges facing the Equator programme is to devise methods for *understanding interaction* for the purposes of design. In this paper, we discuss how two design groups responded to the challenge, through an exploration of their work.

Both these design-oriented workgroups are involved in separate but related *experience projects*. First, we discuss the design and interpretation work of the Computer

Related Design Studio (CRD) group based at the Royal College of Art, UK. They are led by Bill Gaver, who pioneered the development of Cultural Probes [6]. This group of designers is involved in Domestic Environments Project that is developing innovative applications of technologies in the home. This is followed by an introduction to the work of members of the Cooperative Systems Engineering Group (CSEG) in the Department of Computing at Lancaster University, who have pioneered the use of ethnography in design [4]. This group employs a multidisciplinary research team to facilitate the development of enabling technologies to assist care for specific user groups with different support needs. The Digital Care Project is concerned with improving the quality of everyday life by developing supporting technologies based on a comprehensive understanding of user needs. The CSEG group has an eclectic approach to methods and is presently utilizing a number of cultural probe techniques.

Our investigation of the work of these two groups is not solely concerned with evaluating the methodological rationale that underpins the use of the cultural probes approach. The aim is to promote an understanding of the ways in which methods and procedures, strategically combined, produce beneficial outcomes for collaborative design work.

THE CULTURAL PROBES 'APPROACH'

The initial impetus for this paper arose from a methodological interest in 'Cultural Probes'. Particularly the ways in which non-scientistic art and design methods might lend themselves to design studies of socially sensitive settings. We were curious to understand the relationship between (a) the Cultural Probes and the more conventional collaborative approaches to design research procedures such as ethnography, and (b), how practitioners from different disciplines go about the practical work of operationalizing Cultural Probes' novel non-scientific approach to design.

The Cultural Probes approach [7] has recently gained some prominence as means of 'inspiring' interactive design. We employ the notion of a 'Cultural Probes' as a generic term that glosses a distinct methodological approach, and so incorporates technology probes, domestic probes and the like. Within a domestic context, the approach is concerned to address both what role technology might play in the home of the future and, specifically, how it can support existing domestic values. The Cultural Probes approach, Gaver argues, *"act[s] as a design intervention that elicits inspirational material while avoiding the understood social roles of researchers and researched"* [6]. For Gaver, the 'inspirational' approach, utilized by the CRD team, brings the user closer to the design space in a way that is seemingly different from conventional ethnographic methods. In particular the variety widely used in domains such as Computer-Supported Cooperative Work (CSCW) to uncover, elicit or validate 'requirements' for technologies.

Our initial analysis is based on an ongoing investigation of the design domain and incorporates what can best be described methodologically, as taking the ethnomethodological turn to studies of work. Following Sharrock and Hughes recommendation, our approach places an emphasis upon the extent to which our reports are joint productions- things that have been orchestrated by us and those under study [12]. Secondly, it emphasizes the "extent to which the organization of the social setting is a 'joint construction'- something that is done *between* and *together* by the participants in the setting" [their emphasis]. We would argue that it might also be analytically useful if the notions of participation and collaboration were elaborated to include inter-collaboration- with the 'subjects' of study (lay members) and intra-collaboration- between researchers (experts).

INFORMATION OR INSPIRATION?

It is important to point out that each workgroup adopted Cultural Probes for different reasons. The theoretical and methodological concerns manifested in the Cultural Probes approach developed by Gaver and Dunne [7] is located in the philosophical tradition of the artist-designer. Given the CRD group's pedigree it is not surprisingly that Cultural Probes play a central role in the CRD approach to design. Alternatively, the CSEG group has a Computer Supported Cooperative Work (CSCW) background and concentrates on bringing ethnographic findings to bear upon design matters. In the Digital Care project, however, the group's ethnographer has made a pragmatic adaptation of the CP approach in order to be sensitive to the context of the research setting. Introducing a probe package has provided CSEG designers with ways of collecting contextual ethnographic information unobtrusively from a socially sensitive setting.

Cultural Probes have been deployed recently in a number of innovative design projects, for example the Presence Project [5]. In this study, the Probe pack (See figure 1), comprises a collection of materials specifically designed to elicit inspiring responses from people in domestic environments. Probes objects are viewed primarily as a way of capturing a sense of emotional forces that shape people's home lives.

Figure 1. Domestic Probe Pack

Designers draw upon Probe returns as “inspirational data” for their design work. In the CRD study probe objects include: cameras, household rules packs, a pinhole camera, a family and friends map, photogram paper, a domestic routine diary, a ‘listening’ glass, a floor plan sketch pad, a dream recorder, a bathroom pad, a visitor’s log and a telephone pad.

DESIGNING CULTURAL PROBES

We now move on to a brief overview how the work of designing and constructing Probes gets done. To begin with, we have provided a list of headings outlining a schedule[1] of probe design activities.

1. Planning
2. Recruiting Participants.
3. Selecting Volunteers.
4. Assembling Domestic Probes.
5. Deploying Domestic Probes.
6. Retrieving and Analysing Probes.
7. Speculative Design.

Having recruited 20 households from the Greater London area, the CRD group visited each household to conduct preliminary conversations and leave behind 'Probe Packs' containing provocative tasks for the volunteers. The returned items provided a range of text and images media that provided a myriad of fragmentary glimpses into peoples' domestic lives and aspirations.

Generating ideas and constructing innovative and effective probes involves a range of skills, experience and working knowledge of cutting edge design matters. It also requires an understanding of graphic and product design, craft skills such as model making and photography, together with a range of skills including the use and deployment of a range of computer based design programmes. CRD designers regularly demonstrated a tacit appreciation of the putative aesthesis and sensitivities of the volunteer participants. Moreover, these professional skills are seamlessly combined with an ability to deal with an indeterminate variety of mundane contingent matters. For example, the types, forms and potential functional properties of a vast range of material and mediums together with a broad working knowledge working of their costs and availability.

Essentially, Domestic Probes are purposefully designed to provoke, reveal and capture the motivational forces that shape an individual and his/her home life. CRD ddesigners’ work regularly involved informal and impromptu discussions in the studio and other locations. During these work oriented conversations, ideas for probe objects were ‘worked up’ through a process of organising a working division of knowledge and labour. Visualisations in the form of crafted prototypes, models, sketches and/or verbal descriptions of objects were all considered candidate material for design discussions.

In short, talk was central to the design process; in that assessing ‘just what counted’ as ‘appropriate’ for a probe object, was a negotiated matter. A tacit local working agreement, on what functional and aesthetic qualities were relevant for an object to be classified as a candidate for inclusion, was arrived at and maintained in and through the talk of the designers.

In terms of the specific details, however, most of what was observed consisted of a complexity of practical sequential activities that emerged during the course of work rather than follow predetermined process. Time does not allow for a full account of each step in the process. We focus on selected stages in the designing of the probes themselves, and the ways in which the CRD team develop their ‘inspirational’ probes to inform a participatory approach.

Planning

During the early period of their work, members of the group regularly discussed their proposed project at length. Our arrival occurred just after the start, when planning consisted of designers talking through the ways they envisaged their work could be organized. In this way, they began the process of organizing the ways in which the work could be distributed amongst the group. Talking provided a way of elaborating and sharing their knowledge of design and established a sense of just who had practiced skills and experience, and in which particular area of design work. Conceptual matters were also a design issue and featured at this stage in designer’s talk.

Over this period, the group arrived at a tacit agreement about the rules that govern the form, functions and aesthetic properties of a Cultural Probe. The design requirements or brief (although it was never expressed in such a way) for any probe object or artifact was that it should be capable of probing and recording participant’s feelings about their life and their home, eliciting some kind

[1] The headings used here are for presentational purposes and do necessarily reflect the real-time temporal ordering of the work.

of emotional response. Ideally, each probe object should be capable of invoking a different form of response that fits within a category of acceptable emotional responses e.g. playfulness, anger, sadness etc. It is clear that design work here was very much a case of anticipating known in common experiences.

To sum up this formative stage of the project, much of the designers work was concerned with talking through plans. They ‘bounced concepts off each other’, ‘knocked ideas about’, made suggestions, recommendations and endorsements regarding the possible properties a probe object could embody. They talked over putative responses certain ‘kinds’ of objects ‘might’ elicit and, what features functioned to provoked ‘these’ reactions. Together, during their ‘working’ day in the studio, during coffee breaks and later in the bar, they spent a lot of time arguing and joking, made up stories, made sketches, kept notes, and talked over previous and possible scenarios. In short, they worked up the detailed form and function of the Cultural Probes.

Selecting Volunteers.

The CRD group had initially carried out a mail drop as a first attempt to recruit volunteers for the project. However, the response to such unsolicited mail was poor. In February 2001, advertisements for volunteers were placed in a variety of popular London publications - Loot, Evening Standard, Time Out, and Country Life. The administrative staff at the RCA was responsible for fielding the telephone responses from candidate volunteers and sending out pre-printed acknowledgements. Information regarding the number of responses and descriptive accounts of ‘interesting’ telephone calls were relayed to the CRD designers. These versions of the telephone conversation provided the CRD team with verbal images of the ‘type’ (social type) of person the administrative staff recognized making the call.

Volunteers deemed to be suitable candidates for consideration were visited at home, usually by two members of CRD designers. These initial meetings provided an opportunity for the CRD designers to assess the candidate ‘suitability’ and to survey the candidate’s home. The meeting also provided the opportunity for the designers to explain in more detail the context of the study and gauge the initial reaction of candidates. This first meeting provided the appropriate opportunity for the designers to enquire about the participant’s personal circumstances and family history and domestic living arrangements. Invariably, they would be invited to look round the home. Participants would be later informed, usually by telephone, if they were successful. Providing firm dates for probe pack delivery was initially difficult, as they had not at that time been completed. Post cards and envelopes incorporating initial enquiries from the project were used “to keep participants interested and involved” and provided additional background information. Arrangements were made some time later to arrange mutually convenient dates for the delivery of probe packs.

It is interesting that non-design administration staff contributed significantly to the study through their involvement in the designation of suitable volunteer candidates. The skills required to select ‘appropriate’ candidates were not grounded in any design philosophy, but rested upon their tacit knowledge of designers and their lived experience.

Assembling Probes

The practical work of designing, constructing and assembling the Domestic Probes Pack started at the very beginning of the project and had continued throughout the planning, recruitment and selection phases. Almost from the very beginning of the project the group had come to an agreement that they would include a camera but one that would be used in a quite specific way. The *“PROBE CAMERA”* (see figure 2) – was a repackaged disposable camera.

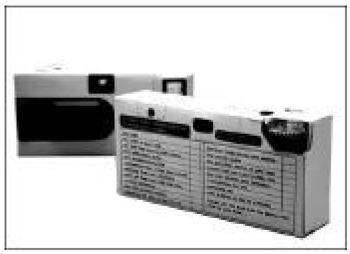

Figure 2. Probe Camera

Using the camera, volunteers were instructed to photograph the spaces, objects, scenes and people in their domestic environment. Printed on the back of the camera were questions that included: *"who lives in your home"*, *“your most private object"* and *"a photo at 8pm on a Sunday "*.

The camera itself is not an unusual object. What is unusual, however, are the recommendations for its use. The design ‘problem’ was to contrive to make the functional use of the camera an aesthetic experience. The theory here was that using *this* camera could afford participants with an exceptional experience. ‘Strangifying’ or distorting the appearance of an ordinary object would, it was argued “encourage from respondents a slightly detached attitude to our requests” [7]. To achieve this, the camera- a cheap, disposable, but nevertheless professionally designed device - was repackaged by a member of the CRD team. Materially, the cameras packaging was transformed into an ‘aesthetically crafted’ object rather that a commercially manufactured consumable. The objective here was to attempt to "reduce the distance between the designers and the participants through the intervention of a probe [object]" [5].

CULTURAL PROBES AND THE DIGITAL CARE PROJECT

In contrast to the 'inspiration' approach as utilized by the CRD group, the Digital Care ethnography used the probes for 'information'. This is a response to the particular problems of using ethnographic techniques in sensitive, care-oriented settings Ethnographic studies [9] claim to provide a 'sensitizing' to the 'real world', 'real time' character and context of everyday life and the facilitation of what Anderson [1] calls 'the play of possibilities for design', in this case the socially organized, naturally occurring uses of technology in domestic interaction in a care setting.

Over the past three decades or so ethnography-oriented techniques have emerged that have promoted an understanding of the nature of organisations and the different forms of interaction that underpin organisational life [2]. With its early focus on business systems and office automation the ICT community has, over time, incorporated a range of techniques to support design particularly for workplace environments [13]. Ethnographic approaches to field studies continue to produce valuable insights into existing and emerging work practices of use [10]. However, the use of ethnography-oriented techniques for studying social settings such as the home is relatively immature and under evaluated by comparison. This is partly because it is a relatively new are of study but also, and of at least equal importance, because the ethnographic techniques themselves are constantly adapting to the setting or domain being studied.

What follows is an account of the use of a CP derivative for the Digital Care project. This will then allow for a comparative analysis of the 'inspiration' and 'information' deployments of CP's, highlighting our main themes exploring the nature of participation and design in these two approaches and the roles of the researcher and the researched.

The 'Digital Care' project employs a multidisciplinary research team to facilitate the development of enabling technologies to assist care in the community for particular user groups with different support needs. The general aim is to examine how technology can be used to provide various kinds of support to sheltered housing residents and their staff. The setting for the project is a hostel and nearby and associated semi-independent living accommodation, managed by a charitable trust, for former psychiatric patients. The hostel is the initial location for former psychiatric patients leaving the psychiatric wards of the local hospital that are themselves in the process of being closed down as part of a more general move towards 'community care'. In the hostel, residents are provided with a room and are monitored and helped to develop independent living skills by a number of qualified staff. Residents then move on to another, semi-independent living site, which is sheltered housing consisting of a number of flats and bed-sits, prior to eventually moving out to flats in the local area, or, if they are deemed to need further and continuing support, back to the hostel. Emphasis is on the learning of daily living routine and skills and consequently any technology introduced should contribute to this goal.

One objective of the 'Digital Care' project is to improve the quality of everyday life by building and adapting technologies for a range of user groups and application domains. Consequently, it is very much concerned with developing supporting technologies based on a comprehensive understanding of user needs. A technology that merely completes a task for residents does little in producing independence but merely shifts reliance onto the technology. Thus, the emphasis here is on assistive or enabling technology.

Within the 'Digital Care' project, the methodological response to the issues raised by our focus on context and user-led design has taken a number of forms and remains under active consideration and revision. At present CSEG are exploring and modifying various forms of observational and ethnographic study, user-centred design and evaluation and the use of 'cultural probes'. The specific focus is on technological intervention to support everyday life. Observational studies have been supplemented with relatively informal interviews and, what some might call 'technological tours' [2]. The interest is in how residents organize their day, the kinds of things they do and how they go about doing them, their use of technology, the organization of their personal space and so on.

'Cultural probes' have been adapted in the Digital Care project as a way of uncovering information from a group that is notoriously difficult to research. In this particular case, the residents involved in the study have medical conditions, e.g. paranoia, which would make conventional observation techniques at least inappropriate and potentially damaging. They are also a way of prompting responses to areas that are equally difficult to uncover - users emotional, aesthetic, and social values and habits. 'Cultural Probes' - in this case consisting of various Polaroid and disposable cameras, diaries, maps, a tape recorder, photo-albums, and postcards etc - were a method of supplementing ethnographic investigations, and as an engaging and effective way to open a dialogue with users. The aim here is to elicit new and different information through using the probes, anticipating that they could be used to provide more substance to design ideas that had surfaced in the course of the interviews or observational periods. Although this project is in only its early stages, it has already resulted in prototypes for a self-medication device and communication devices for staff [13]. A PD-oriented design workshop with the staff has also been held.

DISCUSSION

Our analysis of the studies carried out by the CRD group at the RCA and CSEG group at Lancaster University provides one of the first evaluations of the interdisciplinary approach which has led to the adaptation of methods across disciplines in the use of participatory approaches to design oriented practice studies.

The techniques developed to study the workplace may, on the face of things appear inappropriate when applied to the differently organised institutional social settings such as the home; whatever form that might take e.g. a place of care and support. Technology design approaches that have emerged from the workplace have, quite rightly, been situated within the core rationalities of production, efficiency and the organization of labour. However, it is debatable whether these post-Fordist principles could be applied to small but complex social environment glossed as the 'household'. The utilisation of Cultural Probes is a way of addressing the methodological challenge posed by the 'home' setting. We are aware that there are many relevant issues concerned with the purported differences in the study of home and work settings and the blurring of the boundaries between the two. We deal with this particular debate elsewhere [8].

One consequence of the shift in emphasis from the workplace to the home is that it has provoked a reassessment of approaches for (a), analysing and representing domestic life then (b), conveying the 'findings' to designers. A notable exception here is of course the Scandinavian design school. Here, there is a long history of participatory design that has developed into a practice imbued with notions of the community and the sociality of design. For example, the cooperative/participant design research studies of domestic life of Bjerknes et al [4], Bødker et al [in 4] and, more recently, the 'interLiving' project [16].

For those engaged in formative design studies of social settings, the creation of future technologies for domestic environments offers a number of interesting challenges. Gaining a comprehensive understanding of needs or an insight on user requirements in such domains is central to this. Predominant in designing for future domestic environments is the key research issue of understanding the everyday character of the existing social and physical arrangements within the home; how people live (and sometimes work) together in the home, what they do when they are at home, and the existing and potential role of technologies within the milieu of domestic activities. Consequently, understanding the relevance of context specific behaviors and the situated use of technologies are elements that should have relevance in the design space, along side fundamental cognitive notions such as tasks of tools [9].

Clearly, both groups are using Cultural Probes as part of an ongoing design process. The trajectory followed by the CRD group over the first two years starts with design-driven methods for understanding people. This phase will be followed by concept proposals and technology explorations, and tests of novel configurations of technologies in participants' homes. It is important to note that members of the Home Technologies design group were not coming to the project as complete novices. Each member had practical, practitioner-based experience in the design community and so fully understood the user-centered, design-driven process. In addition, each member of the group has had either direct experience[2] or was familiar with the Cultural Probes approach [6].

Before the substantive work of designing domestic technologies could begin however, the CRD group was faced with a preliminary 'design challenge'- how could familiar objects and artifacts be reconfigured in such a way that, not only were they capable of triggering emotional reactions in a respondent but that they were able capture the context in which those responses were occasioned. In short, the function of all domestic CP objects is to capture for analysis the motivations that shape home life [6].

Unsurprisingly, each of the five members of the group appeared to share a common disciplinary approach to computer related design. It was, however, apparent from their talk that each oriented to probe design issues in different ways. As individuals, they were hired for the particular skills and knowledge they could contribute to the project. All acknowledged that as a 'team' their fundamental problem was a practical one- how to design probe object that would be perceived and function in the way in which it was intended. There was much talk about the appropriate use of a CP object. There was also a concern that the normative understanding of the use of everyday objects would prohibit an interpretive response.

Using Probe objects required participants to be creative, to think about what they take for granted and report upon that which is intimae, private often deeply personal. The group worked together to compose a form of words that would provide clear instructions on how to use the object i.e. guidance on how to get objects such as a camera or a tape recorder to function correctly. Embedded in these sets of instructions were cryptic clues as to when, where and how they should be used. As Gaver makes clear:

".. we were after "inspirational data" with the probes, to stimulate our imaginations rather than define a set of problems. We weren't trying to reach an objective view of … needs through the probes, but instead a more impressionistic account of their beliefs and desires, their aesthetic preferences and cultural concerns".

We are not aware of the existence of a document that formally recorded the group's plan or laid down a schedule of proposed work to be done but that is not to say that a plan did not exist. The 'plan' for the work of designing and producing the probe, and the design work that resumed as probes returned, was regularly invoked throughout the time of our study in and through the talk of the members of the group. As the daily work proceeded there would inevitably be situations or events that called for variations in the plan. The plan was flexible, revisable and ultimately contingent on a range of indefinite variables.

As we have previously remarked, this group, like many other groups of knowledge workers, spend a great deal of their time talking. This talk enabled them to know what is relevant. Talking about designs involved the use and development of their specialist vocabulary. This ongoing knowledge, together with personal experience, acquired skills and an understanding of the history of previous Cultural Probes studies provides both the contextual framework for their expectations and the resource for design work.

This 'talking' about the work continued throughout our visits and appeared to be just as integral to the creative process as the work of computer-based design skills. Understanding and using a range of professional CAD applications was a skill each member regularly employed in their work.

The Lancaster group's probe pack consisted of a camera, an event diary, maps, an audio tape recorder and postcards. These objects provided a way of eliciting and recording information from a group that would be difficult to study by other ethical means, and as a way of prompting responses to users emotional, aesthetic and social values and habits. Incidentally, handing over and collecting the probes proved to be appropriate opportunities for unstructured interviews with users. Apart from some color coordination and their appearance as 'presents' the general approach has been to make the probes stimulating and fun (though, as it turned out, they could be 'too much fun' and in one instance resulted in 'rude' photos of various residents). To give some examples of the probes - residents were supplied with Polaroid and disposable cameras and asked to take photos of their rooms, things that were important to them and were asked to put the Polaroid photos in the photo album supplied with the probe pack and "write what you like about them, why you took them, any thoughts...." and were provided with 'post-it' notes to attach any comments. The provision of disposable cameras provided the researchers with a useful opportunity to open up a friendly dialogue with residents based around the return of the developed pictures. Another probe was a map of the local area and various colored pens and 'post-it' notes to enable residents to indicate favorite places, areas where they felt safe or threatened and so on. In this way the probes clearly had an 'informational' focus as opposed to Gaver's emphasis on 'inspirational' use.

Participatory design has, necessarily always been sensitive to the political context of design. In the case of 'Digital Care', the project, and any associated technical development, takes place within a particular political and moral framework. The challenge for design in these settings therefore, is not just to recognize this dilemma but to steer a careful path through this moral minefield. Embodying a philosophy of care into design necessitates considering issues of empowerment and dependence and then thinking how these might usefully become incorporated into design guidelines.

CONCLUSION

One of the objectives for this paper was to explicate the practical, real world nature of creative and imaginative design work. However, readers will no doubt be aware that there is a variety of discipline-led approaches to design research (psychology, cognitive science, sociology, engineering etc). The existence (or co-existence) of this range of approaches is not in itself an issue here. That said, what is problematical is that a discipline's philosophical attachment to certain theoretical matters drives an attachment to particular methodological procedures. This preoccupation with methodology often masks what is really required, 'a more adequate- often more detailed- rendering of the domain being designed for' [14]. We demonstrate how two seemingly discrete disciplines deal with this apparent problem.

This paper provides an initial evaluation of both these user-centred approaches to design studies and asks whether current approaches to the design of new technologies are appropriate in such intimate and sensitive settings. Both groups have begun to explore some of the methodological options opened up by the use of 'cultural probes' and a combination of a derivation of cultural probe and ethnographic study [13]. For the authors, providing an ethnographically oriented view of just what 'doing' design studies consist required that we attempt to relay our understandings that have been 'appropriated' [14] during our field study. It also illustrated the way in which the ethnographic approach is in itself an intrinsically collaborative affair, particularly the participant observation techniques.

This notion of collaboration extends to the work we observed in the CRD studio - it could be characterized as an intra-collaborative achievement. Design work here is plainly a social activity that involves and is organized around the sharing and exchange of ideas. We observed that, in and through their talk, members of the group exchanged personal information and continually repaired their understanding about each other. These ongoing biographical exchanges provide each member with context for their own, the group and participants behavior. Seen this way, contextual knowledge provides a way sensitizing and accommodating each other's actions and ideas in an appropriate manner.

A key issue brought out through our evaluation of the work of the CRD team indicates that much of the apparent gathering of 'inspiration' rests on ethnographic 'information' gathering techniques. It is clear that, in the course of the visits to the homes of volunteers, designers were implicitly involved in eliciting ethnographically-oriented data. This in turn provided a contextual sensitivity to the individual settings. We would argue that it would be a mistake to try to separate the mutually constitutive activities of designing and deploying Cultural Probes and the gathering of information about volunteers and their home lives. From our evaluation, the apparent methodological dichotomy that results from an attachment to theory is dissolved in practice.

The probes deployed in the Digital Care project were certainly less well or less obviously 'designed' than those produced in the CRD studio. Despite this fundamental difference of focus, there are also some similarities in the way cultural probes have been used. Like Gaver the CSEG group envisaged probes having a provocative in eliciting informative responses;

"we anticipate that the probes, the feedback on them as well as the periods of observation has enabled us to overcome some of the 'distance' between us and the residents and staff at the hostel" [13]. In this sense we would concur with Gaver's statement that: " The cultural probes were successful for us in trying to familiarize ourselves with the sites in a way that would be appropriate for our approach… They provided us with a rich and varied set of materials that both inspired our designs and let us ground them in the detailed textures of the local cultures" [6].

No doubt, the art and design philosophy underpins the probes approach, and the anti-scientific stance that many might find novel and appealing. Probes, however, are primarily concerned with understanding people *in situ*, uniquely, not abstractly *en masse*. The results of the probe exercise, in both cases, demonstrate, as one might expect, the highly individual (emotive, idiosyncratic) nature of participants' home lives.

To sum up, we would argue much of the design work in the domain of the 'home' has been technology rather than 'needs' led - perhaps because gaining a comprehensive understanding of needs or a perspicuous view on user requirements in this domain poses a number of interesting and difficult methodological challenges. It is not just that many of the important ethical and deployment issues concerning the development and evaluation of real systems remain unexplored, but that methods for eliciting needs in such a complex setting are relatively under-developed. The extent to which the relatively well developed methods used to understand work environments can simply be transposed to investigation of domestic environments is doubtful, and 'care' settings in particular represent a very different set of design and methodological challenges. Preliminary research of the Equator projects suggests that new conceptual models, theories and guidelines are needed, but that variations on the idea of a cultural probe may suggest a way forward.

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A Pattern Language for Living Communication

A Global Participatory Project

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ABSTRACT

This is the first report on an ambitious participatory project, currently in work, whose goal is the construction of a "pattern language," a large structured collection of knowledge that represents the "wisdom" of a widely distributed, very loosely knit community of activists, researchers, policy-makers, and technologists. This report provides an important first step as it outlines our hopes, expectations, planned tasks, and research hypotheses. A second report in late 2002 or early 2003 will bracket this report with a discussion of actual activities, evaluation, and recommendations.

Keywords

Pattern Language, patterns, participation, democratic communication, collective knowledge base, constructivism.

INTRODUCTION

"All of my life I've spent making living structure in the world." –Christopher Alexander (1996)

In November 2001, CPSR's DIAC-02 symposium program committee embarked on an ambitious participatory project whose goal is the construction of a large structured collection of knowledge that represents the "wisdom" of a widely distributed, very loosely knit community of activists, researchers, policy-makers, and technologists from around the world. This collection will ultimately be a "pattern language," a somewhat complex theoretical structure which is based on the insights of professor emeritus Christopher Alexander and his colleagues at the Center for Environmental Design at the University of California, Berkeley. Alexander's book, *A Pattern Language* (1977) is a classic in the area of architectural design and theory.

The domain of our pattern language project is "civic and community information and communication." This is a descriptive phrase that contains too many syllables; "democratic communication" might be a better characterization, but *Living* communication, adopting Alexander's characterization may be the simplest and best. The core concept is that certain forms of information and communication systems are likely to be more effective at promoting conviviality in the human and environmental spheres. These systems are also more "authentic" and more equitable; unlike, for example, commercial television whose product is designed to sell merchandise, constructed by professionals with commercial – not civic or community – allegiances, fosters damaging stereotypes, is often unanswerable to the public, and is likely to be the conduit of propaganda. Thus the systems we hope to promote are more likely to be equitable and participatory. They will support what I've called in my book (Schuler, 1996) the six "community core values," conviviality and culture; education; strong democracy; health and well being; economic equity, opportunity, and sustainability; and information and communication.

We hope that the resulting pattern language will be educational as well as inspirational for current and potential information and communication researchers and activists. The construction of the pattern language, however, is not the sole goal; if the participatory process unfolds "correctly" the community that collaborated in the process will be stronger and smarter and therefore better equipped to deal with the issues before them.

CONTEXT FOR THIS PROJECT

Tomorrow's information and communication infrastructure is being shaped today…

But by whom and to what ends?

- Call for pattern submissions, Shaping the Network Society Symposium

This project is explicitly intended to be socially ameliorative in a profound way. The context is global. The environmental crisis, war and militarism, and the stark, growing disparity between rich and poor provide the backdrop. These acute maladies have come to a head at a time when more-or-less unimpeded capitalistic ideology holds sway over much of the world's economic activity and, indeed, ways of looking at the world itself.

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Within this framework a massive communications infrastructure is spreading rapidly into all reaches of the world (unevenly and not without scattered resistance) to a truly unprecedented degree of global concentration. This vast global actuality and potential represents an opportunity (to many) and a threat (to some). As the product (and by-product) of the vast economic forces (largely corporate but governmental as well) this infrastructure is unlikely to consciously or unconsciously promote the type of information that supports social amelioration and transformation. Unfortunately these commercial systems are intended primarily to sell products and make money for their owners and stockholders: entertainment is preferred over news, racial and sexual stereotyping is common. It's interesting to note that until about a century ago nearly all communication was local and unmediated.

Our work is motivated by an acute need for responsive, useful, informative life-affirming communication systems whose existence is threatened by hegemonic, stultifying, and distracting systems. We feel the need to help promote the consolidation of knowledge, creation of shared agendas, and the building of community among the world's advocates for living communication.

WHAT IS A PATTERN? A PATTERN LANGUAGE?

A pattern is a careful description of a perennial solution to a recurring problem within a building context, describing one of the configurations which brings life to a building. - Alexander et al, 1977

A pattern language is a network of patterns that call upon one another. Patterns help us remember insights and knowledge about design and can be used in combination to create solutions. - Alexander et al, 1977

Christopher Alexander's groundbreaking book "A Pattern Language" (1977) is an ambitious collection of interrelated architectural and urban developmental "patterns" which can be used to design and build towns and dwellings which are both beautiful, life-affirming. and *timeless*. Since the book's publication in 1977, it has been a perennial favorite and is used in architectural classes all over the world. The book actually sells more copies with each passing year.

We realize that the meanings of patterns and pattern languages aren't immediately apparent; it's fair to say also that the ideas are not made clear by looking at conventional meanings of "pattern" nor of "language." We are using those terms to acknowledge their intellectual origin and because there are no obvious substitutes that are preferable to the originals. Christopher Alexander and his colleagues at the Center for Environmental Design at the University of California at Berkeley developed these concepts as a framework for their work in the architectural design process.

We are unable to make the same strong claims about the pattern language that we are building as Alexander makes about his. For one thing, it's difficult to say that some of our patterns relating to computer user are "timeless" when computers are a very recent addition to our communication sphere. Maintaining a intellectually skeptical perspective compels us to think of this as a research project with multiple hypotheses; our optimistic spirit holds on to the hope that this work will hold some of the power that Alexander's work has.

There is nothing particularly esoteric about a "pattern." It can basically be thought of as a semi-structured chunk of information (Malone, 1987) that has four main parts: problem, context, solution, and discussion. It is through the use of this common (though minimal) structure that the power and usefulness of the "pattern language" can emerge. Alexander's use of the word "language" is also simpler than it first seems. The "language" is simply the way that the patterns are related to each other and how patterns are used in conjunction with each other much as words are components of spoken or written language.

Below (Fig. 1) is one of the patterns (# 159) in Alexander's book, "light on two sides of a room" taken from the pattern language web site. This shows an illustration of the pattern, the title, a short description of the problem and a brief recommendation.

Fig. 1. Light on Two Sides of Every Room

The patterns in Pattern Language are related in two basic ways. The first is that the 253 patterns are numbered sequentially; number 1 is the most general, and number 253 is the most specific. The patterns are groups within smaller categories as well. Patterns 1-7 are global patterns ,for example, and patterns 35-40 deal with housing that that is "based on face-to-face human groups." The patterns are also linked conceptually to each other. Using the pattern above, right under the main title, in the paragraph that begins, "…once the building's major rooms are in position" there are references to other patterns that come before it, namely WINGS OF LIGHT (107), POSITIVE OUTDOOR SPACE (106), etc. Then, at the end of the chapter, there is a paragraph that describes which of the patterns this pattern is related to that follow the pattern. Thus, the patterns are all conceptually linked to each other much as web pages are conceptually, as well as actually, linked to each other.

OUR APPROACH

Many people outside of the architectural community have also fallen under the spell of the pattern language. The wide range of interrelated ideas gathered together through the simple organizational power of patterns and the language of patterns has been borrowed, particularly by those in the computer field who have begun developing "pattern languages" in object-oriented programming (Tidwell, 1999) and in HCI (Human Computer Interaction) (Gabriel, (1996); Gamma, Helm, Johnson, and Vlissides, 1995). Working with Alexander, Stuart Cowan of the ECO Trust Foundation has developed an impressive pattern language of 72 interrelated patterns which defines " which is a comprehensive and consistent map of a sustainable region, one which may be adapted to the infinite variation of local circumstances." (www.conservationeconomy.net/)

Our project also takes much of its intellectual underpinnings from the basic model that Alexander and his colleagues developed for the architectural domain. We are hoping that we will be able to obtain some of the benefits from this approach that Alexander did, notably a compelling way to organize a large amount of intellectually related material. While Alexander and his colleagues were dealing with architecture, our project explores and constructs patterns in a different domain: The patterns we advance will not focus on physical structure that is beautiful and timeless but on information and communication technology that is democratic and useful. Beyond that are planning to help strengthen the research and activist communities by involving them in a participatory project that uses a combination of electronic and face-to-face venues. We also hope that this effort will help build the community by uncovering deep connections between people and projects that have been unknown to each other. In other words, we are attempting to do for communication systems what Alexander and his colleagues were doing for architecture. When I proposed our basic concept to Alexander in the summer of 2001 he was very enthusiastic; we immediately began discussing the opportunities and challenges that such a project opens up.

This project has the inherent risk that all of its ultimate objectives might not be attained. The aim of constructing a compelling and coherent "pattern language" may be too complicated and too ambitious. On the other hand we believe that the project is designed in such a way that every product and event along the way will have value that will permeate the community and persist in its influence. This project capitalizes on several notable aspects of our era.

- Intense interest and influence in civil society worldwide.
- Increasing penetration of the Internet and the World Wide Web with attendant potential for global collaboration.
- Need for a "network-based" representation of the wide variety of thoughts and approaches related to community and civic uses of ICT worldwide.

We believe that a useful and compelling pattern language is possible (Alexander's "A Pattern Language" is an existence proof) and that we can develop one in an efficient collective, participatory way. Our strategies (below) for developing and disseminating the pattern language are intended to meet our objectives while being specifically cognizant of the capabilities listed above.

- Use patterns as an orienting theme for a conference and information structure.
- Use a common format to facilitate pattern integration.
- Develop and refine social processes (combining in-person and virtual interactions) that support the development of patterns and the pattern language.
- Develop an easy-to-use web application that supports every aspect of the process including pattern submission and review, and pattern language development, access and use, and evolution.
- Publicize the web site and encourage people to post their patterns.
- Provide a scholarly avenue for pattern development and presentation (while also making the project accessible to a non-academic audience).
- Employ web-based and print-based dissemination.
- Build on successes of previous DIAC symposia and the worldwide community that has evolved over the past several years.

There are five primary activities associated with this project.

- An international symposium (the eighth in CPSR's "Directions and Implications of Advanced Computing" series) which will be convened in Seattle in May, 2002. http://www.cpsr.org/conferences/diac02
- The development of a large, collective, shared knowledge base (the "pattern language") through an open online process and face-to-face discussions before, during, and after the symposium.

• The dissemination of this material in both electronic and print-based form.

• Evaluation of process, exploration of issues including a preliminary history and analysis of the social and technical processes.

• Development of a loosely connected worldwide community of researchers, activists, and others who are working in this area.

A central idea behind the common structure is that, while individual patterns are compelling and useful, their structure will make it easier to integrate them (where each is, in essence, a small theory about some part of the communication and information universe) into a collective body. Since they are stored in an online database many interesting possibilities for computer mediation are raised. In addition, we hope that this overall project will inspire scholars to think about their research in terms of social implications and actual social engagement. We also hope that the common enterprise will help build social networks that include research, practice, and advocacy.

All of these activities are devoted to giving shape, direction and power to an interdisciplinary topic that's becoming increasingly popular – and important – throughout the world – that of community and civic uses of information and communication technology. At the same time, however, the simultaneous rise of worldwide civil society (Runyan, 1999) and transnational advocacy networks (Keck and Sikkink, 1998) accompanied by advances in ICT are tempered by other, less positive phenomena: the "digital divide", terrorism, persistence of poverty worldwide, and severe environmental problems. This project directly advances one plausible and direct approach to thinking about and linking our resources and our issues in a new way.

PATTERN LANGUAGE DEVELOPMENT

…towns and buildings will not be able to come alive, unless they are made by all the people in society, and unless these people share a common pattern language, within which to make these buildings, and unless this common pattern language is alive itself. (Alexander et al, 1977)

Although there are many interrelated activities associated with the overall effort I have to chosen to focus on the pattern language itself and the participatory processes we are taking in order to build the product that meets our needs within a satisfactory amount of time.

The pattern language development process consists of six main steps (pattern collecting; pattern discussion and deliberation; pattern language development; pattern presentation; pattern language use; pattern language evaluation). The steps, starting with pattern collecting, are intended to be traversed basically in that order, although some revisiting of previous steps is acceptable and expected.

1. Pattern collecting

Nearly all pattern solicitation has been done via email. In late 2001, the DIAC-02 program released a “call for submissions” which was sent to various electronic lists. The committee contained 34 people from Argentina, Bangladesh, Canada, England, Germany, Ghana, Italy, Japan, Mexico, Netherlands, Russia, Sweden and the US. Nearly all committee members were academics involved in research and activism related to ICT. The call was also included in *Spectra*, the monthly publication of the National Communication Association. The call was designed to appeal to a wide variety of people and to broadly describe the issues that we were interested in addressing. The open-ended nature of the appeal and the introduction of Alexander’s pattern related ideas were, unfortunately, somewhat confusing. Alexander presented his ideas in two volumes using thoughtful deliberate step-by-step discussions accompanied with numerous photographs and figures. Our written solicitations, on the other hand, were intended to be brief and explanatory at the same time – a task that proved to be quite difficult. The easiest way to describe our work was to describe it to people who were familiar with Alexander’s work. I was frequently asked by people unfamiliar and/or skeptical of this approach how I was *sure* that the patterns we received were valuable, the pattern language we will hopefully construct would be useful, and that a pattern language would – or even *could* – capture the “wisdom” (or a meaningful subset) of a community.

Although we are working to ensure that useful products are created throughout the process, the ultimate success will depend on the continued effective participation of the community. This venture, as mentioned before, is innovative and experimental; there are few examples – if any – to be examined that share our broad objectives and global participatory approach. The success of Alexander’s theory and books provide our best reference point: patterns and pattern languages have proved to be compelling and worthwhile to a large number of people.

As for individual patterns (currently unexamined and not having been subjected to a “patternization” process), they will have to stand alone – they will only be as good as the author’s ideas and the dexterity with which they were presented. The structure imposed by the pattern exemplar could, we acknowledge, provide conceptual barriers to potential authors.

To encourage the collection of patterns from all over the world, to be able to display these patterns easily and inexpensively, to facilitate the creation of a pattern language, and to keep the administrative burden as low as possible we devised a pattern management system. This system (discussed below) was specified by Doug Schuler and implemented by Scott Rose using Perl, CGI, and MySQL. The system allows people to basically start their own "author accounts" in which they could manage any number of patterns. Authors can edit their patterns at any time and they can indicate which of several options they'd prefer for their pattern including whether it should be reviewed for presentation, whether it should be made public, and whether identifying information or email address should be displayed on the pattern.

As of February 1, 2002, approximately 150 patterns had been submitted. People from Ghana, India, UK, US, Mexico, Australia, Germany, Sweden, South Africa, Malaysia, France, Brazil, Japan and other countries have submitted patterns (170 or so thus far). The program committee reviewed the approximately 110 which were submitted for review and selected 64 for presentation. All submitted patterns, whether accepted by the program committee or not, are being considered for the pattern language. We have been at least partially vindicated by the patterns submitted so far as the sense that the submissions are beginning to form a coherent set that "belong together." There is also a sense that many implicit conceptual links tie the pattern submissions together in useful ways. There are, for example, several submissions which deal with deliberation -- from the town to the global level -- and with the mechanics for making it happen.

I intend to subject this first set of patterns to further analysis: what countries are the authors from? What themes and categories are represented? Those will help us in evaluating the ongoing pattern language development and in additional pattern solicitation.

2. Pattern discussion and deliberation

This phase and the next (pattern language development) are co-evolutionary and are difficult to separate: progress (or lack thereof!) in one phase often has a direct influence on the other.

The first discussion of the patterns took place among the reviewers (see “Participation by Phase,” Figure 5) which was held at a fairly general level. Reviewers, also, only reviewed 12 or so submissions so discussion on specific patterns was rare. (Pattern submissions were not publicly available at this point.) The “discussions” related to the patterns in this early phase were limited to anonymous feedback to authors. Reviewers also indicated scores on several attributes (see “Pattern System” section) which were used to select the 64 presentations for the symposium.

The conference itself afforded many opportunities for participatory development of the pattern language. These activities were facilitated using Owen's “Open Space Technology” (Owen, 1997), although the symposium’s many objectives (and, therefore, many activities) present some barriers to optimum use of OST according to Owen. We looked at three major areas (Fig. 2).

<u>Patterns</u>
Develop general criteria for patterns
Identify new pattern ideas and add to system
Merge patterns or split into multiple patterns
Eliminate patterns
Refine patterns
Add / remove / alter pattern attributes
Add suggestions, evidence or citations to patterns
Improve graphical content and quality

<u>Pattern Language</u>
Determine broad categories and order
Determine sub categories and order
Order patterns within categories
Establish links between patterns

<u>Entire Project</u>
Publicize effort
Improve web site functionality (support for pattern links or feedback, for example)
Solicit more patterns
Critique process and/or project objectives or approach
Develop / refine development process
Develop guidelines about using the language

Fig. 2. Project development tasks at symposium

It was hoped that participants would produce a set of roles and responsibilities that would realistically balance efficiency and timeliness with equitable participation for the future stages of the project.

These sessions all took place in a single room. There were three notebooks containing the entire pattern set in order of submission. (Each pattern is originally assigned a unique number in order of submission.) The walls of the room were used for the display and re-arrangement of patterns. The patterns were presented in a one page abridged version (showing title, author, problem, and solution) that authors or volunteers developed. Ordinary tape was used to affix the cards to the wall. Postits, string, and other aids were available and the postits were used to supply labels for pattern clusters. New patterns, submitted via the web site from off-site or on-site via wireless laptop computers, were printed and added to the collection in near real-time.

3. Pattern language development

Grouping the patterns into "families" of patterns that share certain attributes is an important part of this phase. The grouping is likely to help the development of the pattern language. It is also -- of course -- intended to help people actually *use* the pattern language. The first use is the development of the individual patterns (as the relate to each other): members of the same family are more likely to be integrated together into new patterns based on the information in the various patterns and, also, are more likely to be linked to each other.

There are three major ways of categorizing the patterns: (1) use the "built-in" themes and categories that submitters indicated when they submitted their patterns; (2) computer-generated; and (3) human guide, either through an ad-hoc, "constructed" or using an existing scheme such as the Dewey decimal system used in categorizing books.

Since the patterns are stored as part of the pattern system there are several potential capabilities that we could obtain from additional computer programming. For one thing we can present the patterns in order from most general to most specific (in terms of themes or categories) as in "A Pattern Language." To accomplish this we just have to specify the ordering of the themes or categories and stipulate a rule that says that the more categories or themes that are checked, the more general that particular pattern is. This could be a substitute for arranging the patterns "by hand" in a participatory way by the DIAC-02 attendees. It could also be used as a set of suggestions or a draft, for the actual ordering. Of course, this approach more-or-less tacitly assumes that the categories (or themes) already established (by the program committee) are the de facto classification / ordering plan.

The automated system could also provide a number of searching approaches. For example, a person could search for all patterns which had "organization" for one of its categories and "education" for one of its themes. One could also search for specific authors or for text that existed within a pattern – in its discussion or context, for example.

There are also several ways in which the computer application aided by human judgement could assist in the evolution from a set of patterns to pattern language. Researchers are now beginning to use text analysis and network presentation techniques to show similarities between texts (Smith, 1999; Sack, 2000). These techniques, in theory, by revealing strong similarities (and differences?) between patterns could help us as we scrutinize, integrate, and edit our patterns. A similar end could be achieved if every pattern proposer would consent to indicate which patterns were strongly related (complemented) to their pattern(s) and / or which ones were actually antagonistic to their patterns. This approach would likely yield useful information. If, for example, multiple patterns were strongly linked to each other (forming a cluster) there is a higher likelihood that these patterns belong in the ultimate pattern language.

Similar approaches to this could be done with context, problem, etc. As shown below (Fig. 3) comparing two patterns in terms of their context, problem, solution, etc. while done by human or machine suggests plausible approaches to pattern reconciliation and, therefore, further development of the pattern language. (An analysis of the *collective* context, problem, etc. would be very useful and interesting whether done "by hand" or by machine.) While this work would be very useful, it's unlikely that the pattern authors would be willing to put in the requisite amount of time to do this exhaustively. In a pattern system of 200 patterns, each pattern author (and some authors have *multiple* patterns) would have to compare their pattern(s) with *all* of the others. In a system of 200 patterns, 39,800 comparisons would be done in total. An important question therefore is how many comparisons along these lines would it take to actually be *useful*; presumably there is some approach that doesn't require total participation (or, even, say, 20%) nor large numbers of author comparisons to yield some useful data.

Context	Problem	Solution	Possible Action
0	0	0	Disparate patterns
0	0	1	Generalize context and/or problem
0	1	0	Resolve solutions Resolve contexts Decompose problems
0	1	1	Generalize context
1	0	0	Group around context
1	0	1	Expand problem
1	1	0	Resolve solutions discrepancy
1	1	1	Merge into one pattern

1 = close match 0 = not close

Figure 3. Comparing two patterns

It is important to note that we are planning other pattern related activities at the symposium including panel discussions by people with pattern language experience.

4. Pattern presentation

Currently the system allows patterns to be listed in order of submission, alphabetically by author's name, alphabetically by pattern name, or in order of invariance. Other methods are, of course, possible, including showing the names of patterns that met some search criteria.

One reasonable, default for displaying patterns would be for the computer to use the pattern “themes” [list them] as a way to order them from most generality to least generality. If we agree that the more themes that are checked, the more general the pattern is and if we agree on a ranking among patterns then an implicit general-to-specific ordering exists.

“Civic Intelligence” (Fig. 4), “Synergies of Fusion: Social Integration of Voice Video Data,” and “Community VPN Portals,” for example, all have all five “themes” checked indicating (probably) wide generality. “How to survive once the government funds run out” and "Using Internet to develop learning environments,” on the other hand, have only one theme checked.

We also plan to develop useful ways of presenting the language as a whole both graphically and non-graphically. Since the pattern language is inherently a network approach to information representation, a graphic interface showing all patterns and the links connecting them seems like an obvious approach. This has been accomplished to good advantage by the "Conservation Economy" site mentioned earlier. That site, however, has only 72 patterns and we are expecting 150 - 300 patterns ultimately. Nevertheless the computer offers potential advantages for interactive exploration that are not available in printed form and that we will be investigating soon.

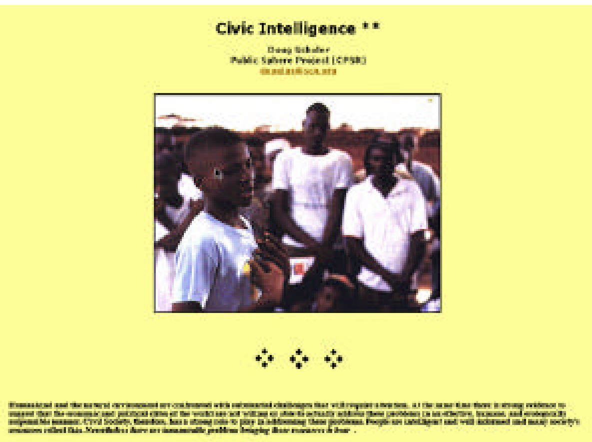

Fig. 4. Sample pattern submitted to symposium

5. Pattern language use

Since the “pattern language” is embryonic at this point, it's not possible to make any observations in regards to its actual use. As before, we will take our initial cues from Alexander. In “Timeless Way” and in “A Pattern Language” Alexander suggests that people select a small subset of the language that they believe they should work with. These should probably be those that have links to other patterns as called out in the patterns. Using that subset, the “builder” should then deliberately, using *one pattern at a time* build the structure. Our domain, while containing concrete elements (computers, books, or libraries, for example) is, in general, more abstract than Alexander's. Also, in our quest for a more effective characterization of our domain for policy, research, activism, etc. we have consciously expanded our sphere to address / engage the broader societal forces that Alexander’s original approach (by his own admission) did not include. We may learn that these other factors may necessitate changes in our recommendations for use. At any rate we will strive to solicit comments from people using the pattern language, share these with others, and revise our recommendations as necessary.

6. Pattern language evaluation is discussed below.

PATTERN SYSTEM

As part of our effort to involve large numbers of people and leverage existing opportunities afforded by the new media we are incrementally developing a web accessible environment for the patterns. This environment is ideally intended to help encourage the cultivation and development of “immature” pattern proposals into a living “ecosystem” of patterns comprising a pattern language.

The Pattern Management System (diac.cpsr.org/conferences/diac02/patterns.cgi) contains five major subsystems (pattern Submission, pattern Reviewing, pattern language development, pattern language presentation, and pattern language administration). The system was developed sub-system by sub-system incrementally on an as-needed basis rather than as a comprehensive set of specifications at the onset. If a new version were created (for, say, the evolution of pattern languages in other domains) the specifications would be largely based on the current system plus what we have learned from the development of this system.

Pattern Submission Subsystem

The pattern submission subsystem allows people to enter patterns into the system, which they can edit as they see fit over time. The pattern attributes include: name, invariance, problem, context, discussion, solution, descriptive image, summary image, categories (orientation, organization, engagement, social learning and intelligence, products and projects, and resources), themes (theory, social movement, education, economics, social critique, media critique, research for action, case studies, community action, digital divide, policy, globalism and localism) and references. Each author “account” is accessed via a user e-mail address and a password. Each author can have any number of patterns under development. The editing screen for an individual pattern allows the author to control whether the pattern is reviewed by the program committee (during the period before submission for committee review was closed) and whether the pattern was ready for public display and whether author name and/or e-mail address was displayed. (All submissions were kept private until patterns were reviewed.) Unfortunately we did not develop a good approach towards dealing with multiple authors. Ideally all the authors of an individual pattern would be able to access that pattern and edit it. This approach would greatly complicate matters (access model and access control) and we did not pursue it. At a more superficial level we plan to add fields to our pattern template where additional authors can be entered and, hence, would be displayed with the pattern.

The pattern information is stored in a database which allows for selective retrieval (e.g. all patterns which indicate as "media critique"), search (potentially), algorithmic manipulation of patterns (e.g. to identify similar or dissimilar patterns), and, finally, to display the patterns in a consistent way.

Pattern Reviewing Subsystem

The reviewing subsystem allowed virtually all reviewing functions to be done via the web. There are two basic roles: administrator and reviewer. The administrator is able to add and remove reviewers and to assign reviewers to specific patterns. Only those patterns which were marked as intended for review were reviewed. The administrator is able to mark a pattern "closed for review" which disallows additional reviewing.

The reviewers do not see names or other identifying characteristics of pattern authors when they review the submitted patterns and reviewers are able to see the reviews of other reviewers. Each pattern was rated by each reviewer according to the following criteria: significance to advancement of knowledge, clarity, innovation, social implications, and suitability as a pattern. The reviewers could also provide information on the proposals they review. There is a textbox to include comments to other reviewers (which are not given back to authors). There is a textbox to include comments which are given back to authors. Reviewers are also able to edit their reviews online. This means that reviewers have "accounts" and the ability to log in.

Pattern Language Administration

The administrator has a global view of the entire pattern system and can inspect and delete patterns (if, for example, a clearly inappropriate pattern had been entered). There are also several report capabilities related to the reviewing process. The system shows each pattern and whether its reviewers are done and which reviewers still need to review. It also shows all the pattern proposals ordered by the averaged scores of the five criteria. Both reviewer and author comments will be shown on these reports. Each pattern has a radio button with four choices (recommended for acceptance, not recommended for acceptance, accepted, not rated) which can only be set by administrator. The system generates different messages depending on this choice and the administrator uses these messages to send to each submitter. The entire database is also downloadable as a spreadsheet.

RESEARCH OBJECTIVES AND ISSUES

The bricoleur produces a bricolage, that is, a pieced-together, close-knit set of practices that provide solutions to a problem in a given solution. (Denzin and Lincoln, 1998)

This project is qualitative research. It's non-repeatable in the sense that we could never repeat the exact circumstances under which this project was carried out. We won't have the opportunity to do it all again with a slightly different set of variables. We therefore necessarily will have to strike a balance between planning, participation, flexibility, efficiency, the need for results. Additionally the "subjects" are all contributors of both the content and directions of the process. Therefore this project is participant-observer oriented; every participant is likewise an observer. This project is designed to "give voice" to a large number of people who are, in turn, attempting to "give voice" to a still larger group. This project is an open-ended participatory program to collectively "grow" a shared vision that combines theory and practice.

This project has important research goals. We intend to learn, for example, how computer support and mediation can help -- or hinder -- the creation of a community largely through the collective construction of a rich resource bank (of patterns) that describes their particular body of shared knowledge. Communities, like this one, are unlike traditional, geographical communities. These "communities of interest" are formed in various ways. A scholarly community forms basically as a side effect of its efforts in developing a shared knowledge base of data, texts, precepts, goals, and methodologies. In this project we hoped to leverage the increasing accessibility of the web worldwide to help develop this community more rapidly (while, at the same time, not rushing to judgement or pre-empting deliberation or equitable participation).

We feel that our online system can help advance this enterprise. The system helps primarily by providing an accessible public input and presentation system. As mentioned previously we believe that the web based system will ultimately offer a wide variety of pattern presentation and exploration approaches. Also, although we have not pursued this as vigorously as we had planned, our approach also suggests a number of avenues for deliberation and feedback. We suspect, on the other hand, that we could develop substantial resources this effort which, in the end, would be underutilized. We do however, have a simple, informal way to allow feedback to individual pattern authors by including a "mailto" on their pattern page (if they've indicated that their address should be published with their pattern).

The urgency of this effort brings us to our second major objective: activism. We are consciously trying to spur interest and action. The project is intended to inspire activism in several key ways. The first is by raising the consciousness of the diffuse communities that already exist and the communities that are now forming and growing. This raising of consciousness is intended, of course, to provide many hints and ideas to the community, much like a how-to book in a given area; the pattern language is educational in the simple sense of providing useful information that will help people more easily achieve their objectives. Beyond that, however, this project -- through the process and the end result -- is intended to bolster civil society generally. First, it shows (ideally at least) that this phenomenon is a worldwide phenomenon in which active work is occurring in all countries with, we believe, an impressive amount of similar perspective and grounding.

Many questions will be confronted in this endeavor: what percentage of ideas put forth in the space of, say, one year, coalesce into something significantly useful? How is the problem of "who is in charge" to be handled, not just in this particular project, but as a general practice if online pattern languages become prevalent? What kind of end products evolve? What kinds of concepts seem to be most amenable to this modality for building concepts? What is the motivation of participants to be involved? How are issues of intellectual property and ownership of coalesced concepts resolved? Are their legal ramifications of use? If so what are they? How are they resolved? What kinds of ideas find this a useful medium for their development? What are the global or international implications of this kind of building of ideas? How do asynchronous (electronic) collaborative approaches reinforce with or detract from synchronous (face-to-face) collaborative approaches and vice versa?

Alexander's fundamental premise, largely implicit, is that the right type of built environment will necessarily lead to the right sort of behavior. While a discussion as to what degree of truth this premise may contain is beyond the scope of this paper, it can be pointed out here that Alexander himself was disappointed that widespread use of the pattern language did not perceptibly change society nor did it even result in houses and other structures that were more beautiful and possessed the qualities that Alexander desired. Alexander blamed this on the fact that the entire building enterprise is embedded in a larger system that dictates how building projects are designed, approved, financed, and constructed. When this larger system is left unaffected the pattern language has less chance of succeeding, according to Alexander: it's boxed in and prevented from realizing the inherent potential of the language.

How do we hope to avoid the pitfalls acknowledged by Alexander as well as the other doubts expressed by members of the civic and community ICT community? For one thing we have explicitly called for patterns that address the larger systems that current information and communication systems are embedded within. These patterns (effectively "meta-patterns") dealing with policy, education, or media critique, for example are explicitly intended to influence the conditions under which information and communications systems must exist.

As mentioned above, it's unclear (at least to me at present) how much influence the built environment has on the lives of the occupants that live within it. The same question can be raised about the hoped-for ameliorative effects of the current project. Like Alexander's, this project is utopian: it's attempting to move society into a direction that many current powerful social forces and ideologies are working against. This critical issue, along with the other important issue of whether progressive change can be institutionalized through words can't be answered here but shouldn't be left aside indefinitely. A parallel question raised by Peter van den Besselaar (personal correspondence) is whether pattern languages "inherently conservative" and inhibit progressive change.

Finally, as Alexander has stressed again and again a pattern language is intended as an abstract tool. It is not intended to be used in a precise, mechanistic fashion. He stresses that their volume opted for abstract (and generally non context specific) patterns and that people should invent new patterns and sub-languages as they desire. He also stresses that the language should evolve over time yet "A Pattern Language," after several printings, has not changed. Is the structure of the pattern language itself a barrier to modification? Most people would agree that the language should evolve. While structurally a pattern language can change over time (by modifying, adding, or deleting patterns) it's not a trivial activity for other reasons. For one thing, there is the "inertia" of the system itself; if the language is a coherent whole than modifying part of it may disrupt equilibrium that the system has. Also, since the system has presumably been constructed in a participatory way, it might not be obvious who is authorized to change the system and under what conditions. Finally, although our (online) system is set up to accommodate various "versions," it's not clear that a version-oriented "software release" model is best.

EVALUATION

Evaluation of this project is crucial and consists of two major inter-related aspects: process and product, especially as they pertain to meeting project objectives. If both aspects of this project are successful the community of living communication advocates will be strengthened and energized. If this community is successful, it will help in the creation of communication approaches that work for more people worldwide.

The evaluation of the process should focus on the quality of the participation as demonstrated by the openness or fairness of the process and its "efficacy" (effectiveness) in producing the desired outcome. This desired outcome includes both a "product," the patterns and their pattern language and a strengthened community. Obviously a process that failed to create a good product could not be considered a success. Perhaps less obviously is the fact that the development of a good strong pattern language in the absence of an open and equitable process would be likewise unsuccessful. If the process is not sufficiently open and equitable, it is unlikely that the product can be legitimate. We are planning to evaluate the process by the quantity and quality of the participation.

There are many interesting challenges and contradictions raised by this project. The first one is inherent in all "participatory" projects and programs (like "democracy"): what does it mean to participate? Who can participate and under what conditions? What are the *rules* and can they be altered?

Whether the "rules" can be changed or not it's undeniable that the initial parameters persist in their influence over the course of the project. As Langdon Winner (1986) states, "Because choices tend to become strongly fixed in material equipment, economic investment, and social habit, the original flexibility vanishes for all practical purposes once the initial commitments are made."" While nobody would quibble with the idea that people are free to set up a project any way they seem fit. If, however, the project is billed as "participatory" and the participants do not feel that their degree of participation was sufficiently genuine then the integrity of the project can be called into question.

Of course if the vast majority of participants believe the project is valid then it probably is. The fact remains that some submitted pattems do not belong in the finished pattern language. (This is simply shown by taking a pattern that is known to "belong" to the system – its antithesis does *not* belong.) If a pattern is judged to be "unsalvageable" by whomever is allowed to make that judgement and if the author(s) are unwilling to make any necessary changes then the pattern should be deleted. In a general sense any decision needs to be "authorized" in some way.

All of this leads to another challenge that this work exposes: that of preserving intellectual "ownership" of the ideas as the evolution from pattern set to pattern language transpires. At the onset the issue is minor; patterns have authors and they also refer to other authors, ideas, and sources in the patterns. Sometimes the pattern author is not the idea author. In my own case, for example, I submitted a pattern on "whistle-blowing" which was based on ideas put forward by the Government Accountability Project (Devine, 1997). This pattern makes explicit the importance – and risk – of publicizing information that powerful people and institutions would rather keep quiet. It also points out the importance of protecting the publicizer of the information; not turning the publicizer into a martyr. In this case I simply made it clear that the basic idea was not mine. I more or less *explained* the idea using the pattern structure.

One possible approach to "ownership" of the process is shown in Fig. 5. The phases are listed in the left column and proceed downward as the project progresses. Further evolution of the language is now listed explicitly in the figure but the process could begin again at practically any phase. All patterns submitted at all (and made public) along with their authors' names will be kept inviolate electronically and in print form. Although the form of the evolving language will continue to change it's important to preserve all original thoughts as well as the legacy of who did what as the project evolved. This dictum suggests that potentially complex authorship exists for each pattern that ultimately becomes part of the language. These contributions could be acknowledged on a pattern-by-pattern basis in an appendix or acknowledged generally.

Phase	Community	Output
Conceiving project	Doug Schuler, Erik Stolterman	Original project description
Developing and marketing project	Program committee	Discussion suggestions
Entering patterns	Anybody with web access	Patterns
Reviewing patterns for	Program committee	Discussion, rating
Reviewing patterns	DIAC-02 Open Space attendees	Discussion, advice, clustering
Reviewing patterns	Anybody with web access	Discussion / advice
Language development	"Official" community	Review, advice
Language development	Advisory committee	Recommendation
Final edits	Editorial board	Pattern language

Fig. 5. Participation by phase

The "product" of this enterprise is essentially the pattern language and evaluating it entails looking at it both as a collection of individual patterns and as a coherent whole. The pattern language must also be evaluated in terms of what it's trying to accomplish. There is the question of whether a pattern language (or other collection of semi-structured information) is in itself even theoretically capable of meeting the objectives we've set before us. Perhaps more to the point there are questions specific to the pattern language that we develop: (1) does it meet the criteria of a "good" pattern language? It is "complete", does it help "generate" living communication, is it timeless? and (2) does it meet the objectives that we've set up for it: Does it provide a solid framework for effective progressive activities in the realm of information and communication and is this framework capable of adapting over time to maintain the usefulness? These three areas are, of course, interrelated: if structured collections of information are inadequate in general then our enterprise is also doomed; if our pattern language doesn't meet the criteria of a genuine pattern language we can't determine whether a pattern language is necessarily inadequate to the tasks of promoting progressive activity. (notes on product evaluation)

STATUS

As of this writing, the DIAC-02 symposium was concluded about this time yesterday (May 19, 2002). Within the context of the symposium a 1 1/2 day "Open Space" session was conducted to further develop the pattern language. Several new patterns were generated, enhancements to the pattern resource system were suggested and many focussed discussions were conducted and recorded. One of the most visible steps forward was the clustering of patterns into several families of ideas. Unfortunately the process for moving the project forward was not determined (nor discussed adequately). On the other hand, several people who were present do appear to be ready to help push the process forward.

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FULL PAPERS

Improved Crane Operations and Competence Development in a Community of Practice

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ABSTRACT

This paper describes the lessons learnt in a five year effort to improve health, environment and safety (HES) in crane and lifting operations in the North Sea. We focus in particular on the roles of groupware tools and a crane simulator in skills development of a particular community of practice, and their role in sustaining and improving crane and lifting operations. This work shows the potential of participatory approaches to design in several respects: the combination of action research and ethnography, stakeholder involvement, dialogue in various arenas, development of new work practices and artefacts, and finally, the politics involved in changing existing work practices and the implementation of new approaches to skills development and the improved quality of working life. We describe the context in which groupware tools and simulation training can become integrated in the operating business in order to improve the development of skills and the quality of working life for offshore crane operators, banks men and supply boat crew.

Keywords

Action research, e-learning, groupware, (HES) health, environment and safety, knowledge management, LOTUS DOMINO, simulation training, virtual communities, quality of working life

INTRODUCTION

Communities of practice have become colloquial in the organization development discourse in recent years [1, 2] and a growing number of publications report on the development of web-based communities [3, 4, 5]. However, less is written on the development of Intranet-based communities, meaning that particular groups or communities within organizations (an exception is [6]) with or without management approval develop their own communities (often with new artefacts) to discuss their work practices and sustain further development. One aspect of this issue that is taken up in this paper is participatory design to support skills development of low status occupational communities within organizations.

While the social life of virtual worlds has been given wide attention in CSCW literature [7, 8, 9, 10], interaction and collaboration in computer-based VR simulators have been of less interest to the CSCW community. As a consequence, few publications exist on how Intranet-based communities and VR can be integrated in skills development of particular communities of practices within business organizations. In the literature we see few descriptions of settings in which simulation training is used to improve skills development (education is an exception, see [11, 12] for examples) and the quality of working life for less privileged groups within business organizations. This paper reports on how skills development has been undertaken in crane and lifting operations in Statoil[1]. We focus in particular on the design of a crane simulator and groupware (LOTUS DOMINO), used for skills development, improved quality of working life, and their role in sustaining and improving crane and lifting operations in Statoil. This work shows the potential of participatory approaches to design in several respects. First, the combination of action research and ethnography. Second, stakeholder involvement; third, dialogue in various arenas, fourth, development of new work practices and artefacts, and finally, the politics involved in changing existing work practices and the implementation of new approaches to skills development and the improved quality of working life.

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[1] Statoil is the State oil company in Norway. Primary activities are the exploration of new oil and gas fields, operation and maintenance of a number of offshore oil and gas production installations, operation and maintenance of refineries, transportation, marketing and distribution of intermediate and end products.

Statoil has used numerous means and methods to decrease the level of unwanted occurrences in crane and lifting operations (from now on called C&L O) on its offshore installations since the mid 1990s. A long-term skills development process for crane operators has been undertaken, together with additional corporate work processes and campaigns that should further enhance work with health, environment and safety (HES). The aim of this paper is to present how groupware and simulation training can be employed in skills development, to sustain and further increase HES in the offshore operation of cranes. The research question is as follows: How can groupware and simulation training improve the skills development and the quality of working life for the existing C&L O offshore community? We focus in particular on the role of a partly virtual crane and lifting community that reflect on and improve their operational practice.

The content of the paper is as follows. We start by describing key elements of crane operations in the North Sea. Then we describe the improvement of crane operations mostly from the perspective of crane operators. After this short presentation we focus the description on the development of a partly virtual community that handles skills development by groupware and simulation training. The groupware applications and crane simulation environment that have been developed are described. Finally, we try to describe some preliminary lessons learnt in a project that is not finished.

CRANE OPERATIONS IN THE NORTH SEA

All types of supplies and cargo to offshore installations in the North Sea are transported to the continental shelf by supply boats. These boats call at installations every day or at regular sailing intervals. A typical year for Statoil has some 6600 vessel landings with more than 300 000 tonnes of outgoing deck cargo and 700 000 tonnes of bulk supplies. The cargo is lifted on board the installations using fixed cranes. On older installations the distance from the surface of the sea to the deck on the installation can be 75-90 metres. Each platform has dedicated crane operators and banks men with the responsibility to take care of the transport from the boat to the deck of the installation, see Figure 1. In addition to this they conduct all internal transport on the installation. As a consequence, crane operations are vital for the daily operation of an oil installation, for lifting up spare parts, piping and drilling equipment, bulk and food. Statoil operates around 50 offshore cranes and a community of 400 crane operators and banks men are directly involved in C&L O. In addition, there are those working in the supply boats owned by the shipping companies that operate on the Norwegian Continental Shelf.

C&L O are high-risk activities for a number of reasons. First, stropped cargo and containers that weight up to 30 tonnes must be handled often with poor visibility during harsh weather conditions and can include operations at night. Also, there can be fog, heavy wind and high waves. Second, new installations are mainly floating (anchored to the seabed), meaning that crane operations have to take into consideration the movement pattern of the installation. As a consequence, new floating installations bring new operational demands. This means new requirements for the skills of the personnel (on the installations and supply boats), and crane and lifting equipment. Third, there is a potential risk for supply boat crew and banks men of getting squeezed between cargo containers, or hit by falling objects. The coordination between crane operators, banks men on the offshore deck and seamen on the supply boat deck is of great importance for safe operations. Finally, the effort related to improve skills development and status for C&L O is not related to improved safety alone. It is also increasingly related to the development of flatter and team-based organizations in Statoil. These new work designs give much more responsibility to the individual. However, they also set tougher demands on people’s skills and lead to more autonomous interaction across technical disciplines and functional borders.

Figure 1. Crane operations on the “real” Gullfaks installation. Photo by Marit Hommedal, The Poseidon Magazine of Statoil

The first rule of crane operation is communication, and the crane operator uses communication to tie various material elements together. If one element fails he is able to use other elements to reconstruct the situation. Let us look at these elements. During operations crane operators rely of eyesight and a set of visible signs that indicate various types of action. A standardized sign language is used for standard situations: lifting the cargo, stop and release the cargo. In addition, they are dependent on the other physical movements of banks men and supply boat deck crew (i.e. walking towards or away from a container). A skilled crane operator is able to see if the latter is a novice and be extra cautious. Shadows are a key element in the interpretation of the position of the cargo. When the crane operator sees the shadow of the cargo because of sunlight or artificial light on the deck, he knows the position of the cargo in relation to the deck. During C&L O a UHF radio is used to communicate with the deck of the installation and the supply boat crew. A multiple communication is another issue and the crane operator is also in direct contact with the bridge of the supply boat if an emergency situation develops. UHF-radio is the main communication device, both for planning (job preparation for potential HES hazards: dangerous goods and discussion between crane-supply boat), and executing the C&L O (direct the overall unloading or loading operation). In addition, the dashboard inside the cabin indicates the state of the crane itself: how much wire is out, the weight of the cargo and the dynamics of the cargo. They use the wind gauge to see the direction and strength of the wind. There is often a video camera on the tip of the boom of the crane that can give an overall perspective of the location of the cargo in relation to the boat deck. A skilled crane operator is able to read the exact location of the crane in relation to the installation or boat deck. These skills are acquired by experience. In special situations like operations in blind zones, the use of flagmen is compulsory, and these direct the crane operator using both hand signals and UHF radio. A standard telephone is used in the crane operator’s communication with other parts of the installation. Very few cranes have PC-networks yet and it is difficult to see that more computer support can improve the robustness of the current communication system. However, computer systems for planning C&L O are on its way, through development of logistic systems that can tell the crane operator the estimated arrival time of the supply boat, the content and placement of the cargo, handle cargo manifests and make it possible for him to enter return goods. However, such systems are not designed to handle the situation of every unique loading and unloading experience and will mainly be one among many resources for C&L O.

Crane operators and banks men, those involved in C&L O, are one of the occupational communities in Statoil with the lowest formal education. Many are traditionally recruited from the merchant marine, and are former seamen. As a consequence, their experience is considerable. At the same time they do the most high-risk offshore activities: for the whole Norwegian Continental shelf (Statoil included). The Norwegian Petroleum Authorities reports that the frequency of these unwanted occurrences were around three a day in the period of 1994-1999.

Experience related to crane operations both on the Norwegian and British Continental Shelf show that most of the occurrences, in the final instance are related to human factors. The direct and indirect reasons for these occurrences have been improper use of machines and tools, wrong procedures for loading/unloading cargo, lack of knowledge of proper procedures for C&L O (often failure in communication), lack of skills and lack of motivation. These are all traits of an unsafe operational and maintenance culture. High-risk industries with an unsafe maintenance culture often have the following traits: components and technical systems like cranes, are run over long periods of time with known weaknesses, or run outside their specified operational and constructed requirements. The two latter phenomena are in most cases related to the work practices of the people on board an installation and comprise a shared and collective weakness. These phenomena exist because the personnel accept that known weaknesses exist on the installation, and that the proper balance between production, profit and HES has not been properly discussed and handled. This weakness is often related to a choice of values; profit vs. safety, i.e. that production is more important than HES. As a consequence, collective decisions are taken that are in conflict with the prevailing safety instructions.

Examples show that crane operations can become a bottleneck, when operations or drilling need new spare parts to keep the oil production up and running. The shut down of an oil installation is very expensive. Such expectations have sometimes led crane operators to operate the crane under questionable weather conditions, i.e. where the wind is over 40 knots. Reported occurrences indicate that accidents occur between different groups: installation deck personnel, the crane operator and the supply boat personnel. These groups have different occupational cultures and dangerous situations can develop during high activity periods. Experiences from concrete or steel seabed installations make the main experience basis (equipment, routines) for Statoil crane operations. New concepts like production ships and floaters require new work routines. In conjunction with this is the increase in the general activity level and effectiveness of operations offshore. The logistics related to supplies in the North Sea have been adjusted to "just in time" principles. Sailing intervals are optimized, and supply boat cargo space is utilized more. The time supply boats spend on each installation is reduced, and an increased activity level makes it more stressful to unload and load supply boats. As a consequence, planning and executing C&L O is more complicated than it used to be. Maintaining a proper safety level places tougher demands on managing, executing activities and employing the skills of those working in this domain.

C&L O has traditionally been a dead end for further career development, something that also coincides with the lack of formal education. To improve the quality of working life and develop meaningfulness in their work many crane operators have become trade union representatives. Very few crane operators have moved up the hierarchy to become middle managers or received more senior positions on the installations. The consequence of all this is that few in management know how skilled top crane operators can be. Lucy Suchman [13] has convincingly argued, that work has a tendency to disappear at a distance such that the further we are removed from the work of others, the more simplified and stereotyped our view of their work becomes. The consequence related to C&L O, until recently, is that what is regarded as "simple" and stereotyped is not regarded as important.

In the development of communities of practice, the existence of arenas where the community can come together, discuss and reflect upon their action is of great importance [1, 2]. Such situations or arenas do not always exist for crane operators. Crane operators are often located in their cranes. They do not necessarily have continuous contact and dialogue with other crane operator colleagues. They work 12-hour shifts, 14 days at a time and then have three weeks off. On newer installations there might be two crane operators. When one is sleeping, the other is working. On the new team-based floating installations like Norne and Aasgard, the crane operator has a part-time position. Due to long intervals between supply boat arrivals crane operators also work as mechanics. This can create additional strain. Onshore periods off make meetings and discussions difficult since crane and lifting personnel live in different parts of Norway. People involved in C&L O have traditionally lacked a community of practice across installations and shifts and the need to come together and discuss their work has not always been sanctioned by management. During the last five years a technical engineering support unit onshore has provided continuity in C&L O expertise. An operational representative, a crane operator in a yearly rotating position has filled an important role as co-ordinator in this core group. This operational representative has both the internal credibility and expertise to function as a liaison between the many offshore installations and the onshore core group. Since 1995 this C&L O onshore support group has arranged a yearly seminar for onshore crane and lifting personnel where overall crane and lifting issues are discussed, and where all installations report on the situation at each installation.

To conclude this section, within C&L O a number of efforts and improvement projects have been undertaken since the mid 1990s to improve safe operations: cultivation of HES values, training and skills development. These projects have set up some mechanisms to sustain and improve safe C&L O. Statoil's vision is to be in the front with relation to HES issues, and the espoused target is zero damage. Could groupware and crane simulation provide additional mechanisms to develop arenas where the C&L O community could meet face to face or virtually to reflect upon present work practice and discuss how future efforts could be undertaken to improve HES in the crane and lifting domain?

THE DEVELOPMENT OF A GROUPWARE TOOL TO SUPPORT THE C&L COMMUNITY IN THEIR DEVELOPMENT AND IMPROVEMENT OF "BEST PRACTICE"

Statoil operates around 50 cranes on 15 installations. Much C&L O is dependent on crane construction, installation type and the local culture of the installation. In the effort of improving C&L O the need to develop joint practice across installations was discussed among the crane operators themselves. They saw that it might be impossible to standardize this practice due to various crane and lifting conditions and situations on Statoil's 15 installations. Still, there were several reasons for wanting to develop such a "best practice." First, crane operators wanted a thorough discussion on the borders or limits of operations. This is the line of operations as usual and "no go" (stop C&L O of various conditions like weather, visibility, and sea conditions). In order to handle expectations in their daily work, from middle management and colleagues, they wanted more detailed guidelines to legitimate a "no go". For instance, a 40 knot wind is "no go," no matter how urgent the unloading operation is for continued operation. Crane operations must stop at 6 metre-high waves. Experience indicates 3-3.5 metres are problematic on floating installations. Second, if Statoil was to improve crane operations, there had to be a number of features of a common practice across the community. The development of this common practice could be a way to create a collective reflection process among the 400 crane operators and banks men in Statoil. Third, a number of representative situations were needed for the crane simulation exercises. A proper involvement of the community was believed to be a future investment in the use of the simulator, see next section.

A project group/task force with offshore crane operators and the onshore crane and lifting technical support was set up. Statoil Research and Technology provided process support and groupware prototyping skills. The task force were 10-15 people depending on the C&L issues to be discussed in that particular session. All Statoil installations were involved either directly in the task force or indirectly through a support group assembled at regular intervals. In a number of workshop sessions the crane operators of the task force defined core elements of this "best practice" based on their long offshore experience. Stakeholders from drilling, marine operations and shipping companies were also involved in this process, since they were directly or indirectly involved in C&L O. A groupware application was developed to support this reflection and involvement process, a redesign of simple LOTUS NOTES application used offshore since 1996-97 [14]. The design process closely coincided with a cooperative and constructive design philosophy with cyclic prototyping [15] and participatory design [16][2]. This LOTUS DOMINO bulletin board was set up more or less at the same time that the work with the "best practice" had started. The latter evolved into an arena that enabled the task force to work with their task force assignments in their spare time on the installation or at home. Since all Statoil employees have PC's with ISDN Internet accounts at home it was also possible to work with their assignments during their spare time. The project wanted to create a channel for communication where crane operators and banks men could discuss their operational practice. This bulletin board could be reached both via the Statoil LOTUS NOTES infrastructure and via a web browser. The bulletin board was a new feature that had been practically impossible in the past, where much dialogue between crane operators had been going on by e-mail or telephone. The only official arena in the past was the yearly crane and lifting seminar.

The task force spent considerable time in discussing the values of the work practice via search conference (Greenwood & Levin 1998) seminars in December 1999 and January 2000. These seminars discussed: what is required to further improve safety in C&L O with given safety targets, what are the elements of a safety culture, how do we communicate with those involved in crane and lifting operations and what are the skills and demands expected from those working in this domain? This discussion and reflection on values formed the basis for the espoused practice that was written down in the winter and spring of 2000. The written and explicit practice did not describe in detail how crane and lifting should be conducted. The situated practices of different installations would have made this impossible. Instead it included tips on important issues, how to maintain the crane, prepare and execute crane operations, how to handle critical situations, how to load cargo with what straps, how to communicate during crane and lifting operations, provide guidelines for special lifts, the transport of persons and internal transport on the

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2 The overall methodology employed here was action research [17]: on site and participant observation of crane and lifting operations, facilitation, informal discussions with participants in the process from the latter part of 1999 and through out 2000 process support in crane community "best practice" workshops in 2000-01 and participation in VR crane simulation sessions. All in all, the action researcher was a "friendly outsider" vis-a-vis the C&L community, that conducted on-site observation, facilitated discussion and reflection sessions in the community and developed a LOTUS DOMINO bulletin board inspired groupware application.

installation. Examples of formulations related to C&L O preparations:

"All lifting operations are high risk. A good practice for each person is to think through the whole lifting operation and evaluate if all necessary efforts for safe operations are taken".

"Everybody involved in the loading/unloading operation must be equipped with UHF communication equipment that have a headset and an integrated microphone"

"A safe zone must be defined before the operations start"

"Personnel on the supply boat must not leave the safe area before being given a "go" signal by the crane operator"

These representations are multiple and ambiguous in character, meaning that the “best practice” formulations are indexical (Suchman 1987:61). The significance of the “best practice” formulations is not found in the formulations themselves. The crane operator must find the ”best practice” useful in particular situations. Even though the formulations themselves were regarded as important, the task force considered it more important to create a common methodology, and a language for continuous improvement and creating a setting in which crane and lifting operations could become systematically discussed in a community of peers. The aim was to "keep the conversation going," meaning reflection and action as a continuous activity.

In the winter and spring of 2000 new functionality were added to the LOTUS DOMINO bulletin board through cyclic improvements. The application was available on the Statoil IT infrastructure. Interested personnel could see the day-to-day progress in the task force. Those interested could make comments on the formulations using real names or be anonymous. In a community with low levels of education writing can be problematic. In some cases the project approached the proposal(s) and discussed the proposal via telephone. All improvement comments were answered whether these were rejected or implemented and the argumentation behind the rejection/implementation decision was written on the improvement comment. As a consequence, the status of the comment could be tracked at any time. The overall functionality of the application included:

- The application contained a fully text indexed searchable description of main aspects of a "best practice" for C&L O in text and rich pictures. It is decomposed from overall issues like HES, via values of a safety culture to larger details like crane maintenance and hints on the change of a crane wire. All descriptions were DOMINO documents
- The ability to write improvement comments to any of the documents
- A specific view for tracking and handling improvement comments sorted as: under processing, rejected or implemented in the "best practice." Additional sorting mechanisms listed the installation name or organization unit
- Links to overall Statoil and government regulations of C&L O

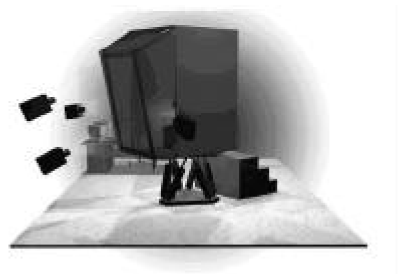

Figure 2. The hiCranesimulatorTM with movement platform, projectors and instructor station

An involvement of major stakeholders was undertaken throughout the process. Through the task force the project had access to important nodes in the informal network of crane operators and banks men. The unions supported the activities, and the project had a steering committee of people with high credibility. A number of meetings were set up with Statoil senior management to report on the development of the "best practice.” A large workshop with offshore middle managers was held in April 2000. This meeting discussed the implementation of the new practice on all Statoil installations. In addition, to keep the work alive, core members of the task force visited all Statoil installations to present the new best practice in C&L and meet middle management and those working in C&L O in face-to-face dialogue.

THE DEVELOPMENT OF A CRANE SIMULATOR TO IMPROVE HEALTH, ENVIRONMENT AND SAFETY IN RELATION TO CRANE OPERATIONS

The idea that a crane simulator could improve HES and skills development in C&L O came from two crane operator opinion leaders. They visited a crane simulator is the US and wrote a report that supported the development of such a simulator in Statoil. A feasibility study was undertaken, a requirements specification was made and a project was set up with the necessary budget provided by Statoil general management. A project with Statoil and two additional parties were set up. HITEC Vision and their subsidiary HITEC O[3] got the contract of building the simulator now called hiCranesimulatorTM. The rest of the simulator facilities, courses and the daily operations were to be arranged by SMS[4] in Trondheim, with the help of two Statoil crane operator instructors. Major elements in the "best practice" should be used to develop training situations in the crane simulator. Even though simulation training never can replace everyday operations there were several reasons to believe that simulator training could improve HES in relation to crane operations. Major aspects of the crane's manoeuvrability, movement patterns, dynamics, speed, time delays, weather, visibility, and load can be simulated in a virtual environment. Crane operators cannot rehearse critical situations offshore because of the safety issues this involves both for equipment and personnel. A large number of Statoil crane operators have worked on traditional fixed installations. When they move to the new floating installations they have to learn to handle these new movement patterns. Many of these new operating conditions can be simulated giving crane operators some early wins in their training and mastering the new situation. The idea is to improve the skills of the crane operators and banks men by going through a number of training situations, like emergency situations and emergency preparedness. They receive feedback on their performance and problematic operating conditions can be repeated until the wanted practice is developed. Everybody involved in C&L O in Statoil will have to participate in these courses every second year. Various courses are made for different types of personnel. Courses include crane simulation for banks men, basic or advanced training for crane operators, repetition courses and co-training with supply boat crew and tailored courses for personnel with special needs, like middle management and technical personnel. All courses combine theory related to C&L O and practical simulation exercises. The simulation exercises start with a briefing (describe the exercise and what is to be done), then proceed through simulation training and end with a debriefing together with a group of crane operator peers, banks men or supply boat crew. Experienced crane operators from Statoil are instructors during simulation exercises. An e-learning home page on the Statoil Intranet has been developed to prepare offshore personnel for crane simulation. This homepage contains the compulsory preparations for the simulation training, including a presentation of the simulator facility, the content of the exercises and its learning model. Links to "best practice" and crane resources on the WWW are also available.

Figure 3. Simulation exercise. Moving a container on the virtual Gullfaks installation. Photo by SMS

The physical elements of the crane simulator are as follows (see Figure 2 and 3). The crane cabin is a replica of equipment used on numerous installations. This crane cabin is placed on a movement platform that can be adjusted to the movement patterns of Statoil's installation types. Projectors visualize the world outside the crane. The simulation or visualization system is run on WINDOWS NT (developed through MACROMEDIA AUTHOR-WARE and 3D STUDIO MAX). The crane simulator software projects images covering the total eyesight of the crane operator, projecting pictures via a front window, two side windows and a roof window. This virtual environment incorporates the physical structures of Statoil's fixed and floating installation types and a number of supply vessels. A number of parameters can be set to manipulate the environment. Simulation software controls the simulator and the instructor manipulates the simulator through three instructor PCs and a TV monitor. Two PCs are used for feeding parameters (different scenarios like installation type and crane type, wind, waves, light, visibility, load type, weight) into the simulator. This means that the instructor can use one machine and peer simulation course participants, the other A third PC gives the instructor a graphical window of the operation from different positions. A TV monitor makes it possible to see what is going on

[3] HitecO is a Norwegian company developing products for presentation, training, simulation and visual tools for optimalisation of man-machine interfaces. Homepage http://www.hitec-o.com/

[4] SMS is the ship manoeuvring simulation centre in Trondheim that offers many tailor-made courses within ship handling and maritime management. Homepage: http://www.smsc.no/index.php3

inside the crane cabin. The instructor has radio and telephone communication with the crane operator. An audio system for simulation of familiar sounds in crane operations and a simulation programme for different crane types using different cargo carriers is also included. Additional collaborative features of a virtual environment are achieved by integrating the SMS supply boat simulator with the crane simulator. The supply boat and installation crew can coordinate each other's manoeuvres during real-time exercises in the virtual environment. In the debriefings the deck and bridge crew of the supply boat come together with the crane operator and banks men to discuss their mutual simulation exercises. The courses are planned so that those taking the exercises work on the same part of the Norwegian Continental Shelf. This means that supply boat personnel and crane operators may have talked to each other via radio before or might meet in future situations.

IMPROVED CRANE OPERATIONS, LESSONS LEARNT

The long-term target of improved crane and lifting operations is the development of a robust safety culture, of which groupware and simulation training already have proved to be of some significance. The introduction of groupware and simulation training came rather late in the five-year efforts to improve HES in crane and lifting operations. In January 2002 Statoil and SMS have over a year's experience with the crane simulation and the "best practice". The deceasing number of unwanted occurrences in C&L O in Statoil operated installations in 2000-2001 can increasingly be connected to the use of simulation training. In 2001, Statoil has had two unwanted occurrences where the crane came out of control due to a technical malfunction. The accident reports conclude that simulation training was instrumental in minimizing the consequences of the accidents, because of crane operators improved skills in handling emergency stops and critical situations. It remains to be seen if the good trend will continue and it is too early to draw definite conclusions in these matters. In spite of this we want to address some of the lessons learnt in the light of participatory design practices.

First, the groupware application based on LOTUS DOMINO has become an important arena where those involved in the C&L O community can discuss their work practices and find useful hints about everyday practices. This application also functions as a repository both for crane operators and banks men in addition to those indirectly involved in crane operations: the supply base, drilling and middle management. In this sense it is becoming a collaborative artefact that ties together C&L O practitioners from different installations. At the same time it is opening the borders to other offshore communities: drilling, marine logistics & operations and supply boats. We see that the groupware tool made in conjunction with the development of the "best practice" made it possible to maximize the autonomy and communication between different installations of crane operators and along the borders to other communities of practice in marine operations. It enabled the different social worlds that participated in the project to maintain a large portion of autonomy in the daily work. Only given parts of the work practices were pooled in the intersection of information outside the crane lifting community, the rest could be left alone. Drilling could use what they needed and so could the Statoil supply base personnel. We have received requests from oil and shipping companies that want to buy the content of the "best practice". Up till now we have turned these requests down for two major reasons. It will make little sense passing over static texts to people in other companies that have not been involved in developing them. We argue that it is the methodology and the involvement process that is unique. It is this process the companies need to recreate in order to develop their own interpretations of the best practice. The "best practice" texts are of less value without the latter and ought to be developed as a part of a long-term reflection in action process.

Second, the work with the best practice and the long-term skills development have taken up the challenge of Lucy Suchman [13] in making the C&L O community more visible in relation to other operational activities. The cynic might say that externalization of work practices have made the crane and lifting community more vulnerable to management intervention. Still, this argumentation is too simple. Our process has demonstrated that crane operators in particular have a peak competence that cannot be ignored. It has also shown the importance of crane operations in relation to other activities since the crane operator is an obligatory passage point for all shipments and lifting activities on the installations. As a consequence, the work with the "best practice" has given the community more self-confidence. In the end this means better ways of handling expectations from drilling and management and has made crane operators, drilling and middle management more reflexive related to "no go" or borderline situations.

Third, as a consequence of the above, the process has led to more openness both within the C&L community and marine operations. The climate for discussing the proper values of a safety culture, its elements in terms of work practices and skills demands have improved.

Fourth, this work has increased the focus on the need for improved education and training within the crane and lifting community. Statoil has lobbied strongly for the development of certificates for apprenticeship in crane and lifting operations. The training model combining discussions of "best practice" with practical operations seems to be a promising way of "standardizing" operational practice and building a foundation for a stronger safety culture through sharing of experience. The Norwegian government is now taking efforts to improve crane training on the whole Norwegian Continental Shelf and developing a specific education in this domain (starting in autumn 2002). These efforts along with new legislation will help to increase the general level of the quality of working life for those working in this domain.

Fifth, the high degree of mobilization that this project has developed in the Statoil organization shows the tiresome process such projects have to go through. This form of skills development is much more than creating e-learning portals and sending personnel to external courses. From day one this project has been a grassroot movement and its career has been connected to the actual skills development needs of the crane and lifting community. The crane and lifting personnel have taken responsibility for their own learning process. The project's success up till now lies in tying together small almost invisible activities and tedious details. Management support has been important but has hardly been enough. The challenge is still to persuade more middle managers and technical personnel to take the introductory crane course. If the groupware application is to remain a catalyst in the improvement of a "best practice" it is dependent upon the continuity of the task force and an informal network of supporters on all Statoil installations.

Sixth, we have used a cultivation approach instead of a re-engineering approach in improving crane operations. Cultivation is a less radical form of change that builds on the existing culture and work practices of Statoil operations. It acknowledges that much is good and can be further cultivated. However, it also acknowledges that change is difficult and acknowledges how original intentions often grow or drift into something else [19]. Cultivation lowers the level of ambition compared to more traditional change processes. Knowledge and skills development processes like the improved crane operation initiative acknowledge that such knowledge processes cannot be engineered. Our way of handling this approach was not necessarily to focus less on plans and targets, but to incorporate the need to seize and be open to opportunities that drift along.

Finally, the "best practice" groupware application is now built around a continuous improvement effort of HES in the crane and lifting domain. It is part of a general methodology for continuous improvement that involves all offshore installations in Statoil and is becoming institutionalized in most settings that deal with crane and lifting operations in Statoil. "Best practice" in crane operations is only viable when it is dynamic. The task force and representatives from various installations that developed the best practice continue to meet two times every year to process C&L O improvement proposals, and decide if they are to be included in the "best practice" or not. They are still key nodes in a community of practice, a position that is also strengthened by the some members' trade union positions. Logged user activities of the "best practice" application in December 2001 indicate that the two replicated DOMINO databases had over 100 hits/accesses every day. This is a considerable amount of hits for the C&L community of 400 that work in three 14-day shifts. Close to a hundred improvement proposals in the "best practice" DOMINO bulletin board have been processed by the task force in 2000 and 2001, related to formulations in the "best practice." This is promising and indicates that it is taken up and become a part of the community. The HES statistics indicate that the rate of injuries and incidents in crane and lifting operations had a historical low level in 2000 and has continued to drop in 2001. The crane simulation courses have been up and running since February 2001. All courses became quickly booked for 2001. Some 200 persons from Statoil's production installations and supply vessels have gone through simulator training in 2001. (In addition approximately 100 persons from other companies have used the simulator in the same period). The response from the operating personnel has been very positive indicated by the fact that almost all of Statoil's available courses were fully booked during the first year in operation. By January 2002 The Shipmanouvering Simulator Center had received bookings for 2002 for close to 650 persons from different companies operating on the Norwegian Continental Shelf.

It has taken some time to get the training up and running smoothly. There have been some technical problems with the software especially after each new update of the simulation software. Most crane operators tell that it is different from operating a crane in the North Sea, the lack of depth (i.e. how far away is the supply boat deck?) in the virtual environment is a challenge. They still report that it is a good thing to rehearse on situations that are impossible to do offshore. The improved self-confidence in the C&L O community cannot be ignored: not only plane pilots have simulation training, crane operators also. However, the most important lessons so far happen during co-training between crane operators and the boat crew. When the co-training courses between Statoil C&L O and supply boats were developed, major Norwegian supply boat shipping companies were keen on taking part in this process with personnel from both the deck and the bridge. The offshore installation community and the shipping community have stereotyped notions of each other. When discussing the everyday work practices from the setting of each "life world" in the courses (a process that started in the development of the co-training courses and continues in the courses), the crane operators experience that what the seamen argue makes very much sense and opens up new perspectives. Out of these discussions a respect for each other's skills can grow that is further cultivated in the co-training sessions between supply vessel- installation. Efforts are taken to run crane simulation courses with people from the same installations. In the co-training sessions with supply boat crew crane operators and banks men collaborate with sailors and navigators onboard ships that traffic the same part of the Norwegian Continental Shelf. In the long run we believe that this will have a positive effect on the daily collaboration and communication between all groups taking part in crane and lifting operations on the Norwegian continental shelf.

Further work with the groupware application and the crane simulator

The major challenge is to keep the work alive in a situation where a number of other company improvement efforts compete for attention and resources. Management support is important but hardly enough. If the groupware application is to remain a catalyst in the improvement of a “best practice” it is dependent upon the continuity of the task force and an informal network of supporters on all Statoil installations. It requires a dynamic process to keep it alive, where IT-support (in the form of IT system maintenance, extranet distribution of the database and CDs to rigs and ships with no Internet connection) is just one aspect. A number of initiatives have been undertaken to align the work with existing organizational institutions and improvement work in general. The improvement work in C&L O has also been aligned with the improvement of marine operations (supply services, anchor handling and towing), developing systems and work practices in marine operations more in general. The community has discussed if more collaborative functionality for virtual meetings should be included in the bulletin board. Mobile PDA solutions of the ”best practice” are possible options if they have EX certificates. Awareness mechanisms and chat-like functionality are other candidates. The development of broad bandwidth computer networks will make it easier to implement computer-supported multimedia training exercises and visualizations. Online training through a simplified crane simulator has also been discussed as an additional feature, since simulation time is expensive. Finally, an enlargement of the community is discussed, incorporating more of the community of marine operations. These include supply boats, drilling and the supply bases of Statoil. The groupware application is part of the Statoil Extranet (via a Marine Portal) and is accessible free of charge to all our vendors and collaborators that are involved in crane and lifting operations directly or indirectly.

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A cognitive analysis of collective decision-making in the participatory design process

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ABSTRACT

In this paper, we examine, from a cognitive standpoint, the issue of collective decision-making in participatory design groups. These multi-occupational group (manufacturing operators, foremen, maintenance mechanics, the method agent, the shop foreman, draftsmen, etc.) are asked to redesign the equipment of a production line in a factory manufacturing steel tubes.

Our analysis is focused on the cognitive side of the redesign activity, and especially on the collective evaluation processes. From the transcripts of the meetings, we have examined how the co-designers come to an agreement about the redesigned equipment. We show that the criteria sponteneously used for the evaluation of the solutions are far wider (quantitatively and qualitatively) than the list of functional criteria prescribed to the co-designers for the decision-making process. This study has led to the development of an evaluation method, named CRITERIA, which is briefly described.

Key words

collective design process, cooperation, collective decision-making, evaluation, criterion

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INTRODUCTION

In this paper, we examine, from a cognitive standpoint, the issue of *collective decision-making* in participatory design groups. This issue arises when the degree of participation is the highest (Jensen, 1997), that is, when all concerned partners are joint to the decision-making process. In these participatory groups, the stakeholders are not only requested to give opinions and suggestions about the future work displays: they are asked to play a role of *co-designer* in the design process.

In our case, the participatory design project aims at *redesigning the equipment of a production line*. The equipment is redesigned by a multi-occupational group (manufacturing operators, foremen, maintenance mechanics, the method agent, the shop foreman, draftsmen, etc.). These people are asked to provide insights for improvements that could be made towards redesigning equipment, in order to increase production quality, product maintenance, product cost, possible transfer to other machines, reusing equipment designed for other uses, etc.

We have analyzed how this redesign process is performed by the group. Do the methods adopted to support the design process meet the co-designers' objectives? Are all viewpoints really taken into account when selecting the solution? How is the collective evaluation of the new equipment performed?

The results presented in this paper go beyond the field of manufacturing industry. They can be applied to any collective design activity (such as concurent engineering or integrated team design), where stakeholders representating various expertises are gathered together in order to design an artefact.

COLLECTIVE DECISION-MAKING IN THE PARTICIPATORY DESIGN PROCESS

(Re)designing does not mean finding the best solution to a given problem, but finding an optimal and acceptable solution with respect to many different criteria (Simon, 1973; Goel & Pirolli, 1989; Darses, 1991; Darses et al., 1996). A single best solution to a design problem does not exist. Alternative solutions can be proposed and compared, but they can hardly be ranged, because one solution will always be better than another regarding a given criteria. Thus, the selection of one solution from the set of the proposed solutions is based on a multi-criteria assessment. This means considering all the fields related to the object to be redesigned, not only the technical aspects but also the social and organisational ones.

This systemic analysis of a problem is at the core of the decision-making process, and is indeed one of the crucial stages of the collective design process (Rasmussen et al., 1991). During this stage, the evaluation of the various solutions is essentially supported by the comparison of the *evaluation criteria* that are put forward by the participants of the design groups during their discussions. The definition and the weighting of these criteria is built and modified through the participants' interactions. The design process requires the integration of all the parameters of the artefact, whether they be technical, social or organisational. Through this comparison of different parameters of the design situation, the co-designers' viewpoints are broadened and enriched.

All these cognitive activities do contribute to the decision-making process. Non-participatory design processes – that is to say, design processes including only "designers by trade" – do have a number of tools to support the decision-making: design methodologies such as functional analysis, CAD simulation or prototype development are the traditional resources of designers to support the solution development cycle, to evaluate the various solution proposals and to make the right design choices.

But in the participatory design processes, most of the participants of the group are *not designers by trade*. The involvement in the design process of stakeholders such as manufacturing operators, foremen, maintenance mechanics, the method agent, the shop foreman, draftsmen, etc., reinforces the difficulties arising during the decision-making stage, since these co-designers have to create their own methodological tools to generate and evaluate the solution proposals.

What are these tools? What are the specificities of such collective evaluation processes, in which the stakeholders' viewpoints are not of the same nature of the traditional technical ones? What is going to differ in the decision-making process? Will the criteria be different? Will the evaluation modes change? This study is aimed at answering some of these questions.

DESCRIPTION OF THE PARTICIPATORY DESIGN ORGANIZATION FOR THE REDESIGN OF MANUFACTURING LINE EQUIPMENT

The factory in which we conducted our study is a subsidiary of a large steel consortium. It manufactures welded stainless-steel tubes for the automobile, chemical, food processing, medical equipment and building construction sectors. Participatory redesign took place in the *manufacturing* department, which had approximately 60 employees, including approximately 40 manufacturing operators, several foremen, a shop foreman, two method agents and several maintenance mechanics, as well as tool and die makers.

Tube Manufacturing

The manufacturing of steel tubes is conducted on TIG lines, so called because of the welding process used. The forming of the tube is done by shaping a sheet of steel with various shaped rollers, which are large pieces of bronze set on axles. The joint is welded, then hammered and polished. The tube is annealed and sawn off at the end of the line, at the length required by the client. It is then packed, ready for shipment.

The production of tubes of different diameters requires the dismantling and assembling of such line equipment as rollers, straightening and hammering tools, support saddles, axles, etc. These operations have become increasingly frequent (due to smaller batches which are specific to each client), quite long (at least 8 hours for a complete equipment change) and physically demanding (the equipment is very heavy). It is shift work (3x8 hours) and each team is responsible for a specific line. The adjustments made during the assembly process and later on when the work is underway determine production quality. It is this activity that demands all of the operators' knowledge.

The Collective Redesign of Equipment in SMED Groups: a Participatory Design Organisation

Description of the SMED Groups

The ergonomic study (for a full report, see Darses, 2002) began with a request made by the production engineer in charge of the manufacturing department. He wanted to have the opportunity to evaluate the benefits and limitations of the participatory redesign groups in charge of redesigning equipment so as to reduce dismantling/assembly time. These groups were assigned numerous objectives, in accordance with the quality policy: to increase production, to standardise procedures, to improve quality and to improve safety. To reach these objectives, two participatory redesign groups were settled, which brought together 5 to 7 people per group depending on the work rotation, for two years in bimonthly meetings. The profiles of the participants varied according to their position, status and seniority in the company. They included manufacturing operators, foremen, maintenance mechanics, the method agent, the shop foreman and draftsmen.

The Redesign Process Followed by the SMED Groups

The groups were asked to apply the SMED methodology - Single Minute Exchange Die - developed by Shingo (1985) to redesign the equipment. Starting with an approximately 8-hour-long video filmed during an equipment change, the group began by isolating the problems involved in dismantling/assembling by measuring the time required for each operation, i.e. the dismantling/assembling of anchor plates, the drop hammer, etc. These problems were dealt with one by one during the bimonthly meetings of each group.

Since the participants of these groups were *not designers by trade,* they had to create their own methodological tools to support the solution development cycle. Here, these tools took the form of a problem-solving methodology. It was made up of three sequential stages:

- The first stage is dedicated to an ***analysis of the problem***, by applying a frame called WWWWHHM. The method prescribes to answer the following questions in order: *Who? What? Where? When? How? How Much?*
- The second stage consists in finding a ***solution to the problem***: various solutions are put forward and written down on a board and, in principle, none are immediately rejected.
- The last stage consists of an ***individual vote***. The solutions are judged on the basis of eight criteria that had been pre-established by the production engineer. These are: *cost, efficiency, safety, accessibility, reliability, simplicity of the system, creation time, installation time*. Each participant gives a score for each of the criteria related to the proposed solutions. The solution with the highest global score is chosen.

The SMED redesign groups adopted a strictly democratic decision-making process. Decision-making authority was not attributed to a specific trade or actor chosen in advance. The method officer ran the meeting, saw to it that the methodology was applied, wrote down the problems and the proposed solutions and tallied the vote, but had no preponderant decision-making role. Likewise, the shop foreman had no official privilege in decision-making, although his position gave him a say in the follow-up to decisions made during meetings. As for the manufacturing operators, though they were seen to be expert about the operational modes and about the process, they had no more decision-making authority than the others.

The method officer was likewise responsible for the technical implementation of the solution adopted. Depending on their complexity, these solutions were either submitted for study to the methods office, or sent directly to the new works department or executed by the method agents themselves in the case of the simplest problems. Prototypes were submitted to tests and definitive solutions were then installed on the lines.

METHODOLOGY DEVELOPED FOR THE ERGONOMIC STUDY

A six-month pre-study led us to establish two levels of complementary analysis which were required to draw up the collective redesign processes: a macro-analysis of the organisational context, and an in-depth analysis of the SMED group meetings.

Juxtaposing Two Complementary Levels of Analysis

The macro-analysis focused on the requirements of the organisational context in which collective redesign was implemented. It was conducted through a regular assessment of the group's work, on collective and individual interviews and on a study of the minutes of the meetings, as well as on the test sessions of the proposed prototypes. This level of analysis stresses the communication paths and inter-department relations, the links with other continuous design endeavours, the role of the actors involved in the process, etc. But we had to go deeper into the functioning of the SMED groups in order to identify the collective redesign processes. This in-depth analysis focused on a cognitive approach of the meetings held by the groups, and especially on the debates related to the evaluation of a proposed equipment.

The analysis presented in this paper was conducted on the transcripts of *five* meetings of one SMED group, each of which lasted two hours. These meetings were chosen because: (i) they focused on important equipment problems and (ii) the issues of these meetings were dealt with within the time scale. They focused on the redesign of two pieces of line equipment, namely the *drop hammer* (which flattens the welding line on the tube), and the *straightening head* (which straightens the tube into a precise horizontal line). With the participants' consent, the five meetings were tape-recorded. The participants to the meetings could vary, according to the rotation of work. The method agent who ran the meetings and the shop foreman were always present. The other participants included at least one manufacturing operator out of the three in charge of the line, and depending on the production requirements, one or two foremen, and one or two maintenance mechanics.

Method of Cognitive Analysis of the Meetings

The cognitive analysis is based on the rationale that the collective decision-making is at the core of the redesign processes and is essentially supported by the comparison of the *evaluation criteria* of the new equipment that are put forward by the participants of the SMED groups during their discussions (Mac Lean et al., 1991; Cross et al., 1996; Bonnardel & Sumner, 1996). These evaluation criteria were extracted from the transcripts of the meetings and were examined.

A *criterion* is defined as any judgement of a solution that is supported by an argument. For example, in the sentence "*it doesn't **cost** too much to make **adjustment screws***", the artefact "*adjustment screw*" is considered to be evaluated by the criterion "*cost*". Other examples of criteria are reported in bold in the protocol excerpt shown below.

Method agent That means ... changing the axle and the support saddle, doesn't it?
Manufacturing operator What's more, it'll **always have to be supported [CR 1].**
Shop foreman You're right, but there'll be **nothing to target [CR 2].** As it is now, we have to target the braces, bearings, everything.
Manufacturing operator Yeah, but it'll **have to be supported [CR 3].**
Shop foreman Ok, **support it and put in a bolt [CR 4].**
Method agent But is there a chance of running into a problem if … ?
Shop foreman Well, we can build in a tiny bit of play **so we can assemble it [CR 5].**

Figure 1 Excerpt from a SMED group discussion

We have extracted 444 occurrences of evaluation criteria expressed during the meetings. For the qualitative analysis, these occurrences have been characterized, according to the object being evaluated and according to their level of formulation. The quantitative results take into account the possible repetitions. For example, in figure 1, we will not count twice the occurrences **[CR 1]** and **[CR 3]**, since they are formulated in the same way by the same person. But we will count two different occurrences for **[CR 3]** and **[CR 4]** because the formulation differs, and the locutor as well.

RESULTS: IDENTIFYING THE COGNITIVE PROCESSES PERFORMED DURING COLLECTIVE EVALUATION

The results of the study are presented in the following sections. They show that the restricted set of prescribed criteria which was established by the chief engineer do not allow a full assessment of the solutions. These problems with the prescribed criteria used by the group for the evaluation of the new equipment lead us to analyze the whole set of criteria spontaneously formulated during the debates.

The Solution Cannot Be Assessed Through a Restricted Set of Pre-Established Criteria

Before our ergonomic analysis could be undertaken, the decisions of the redesign groups were based on a list of 8 functional criteria that had been pre-established by the management, namely *cost, efficiency, safety, accessibility, reliability, simplicity of the system, creation time, installation time.* We call them " prescribed criteria ". These criteria, previously set up by the chief engineer, were the basis for a decision-making grid, from which the solutions were compared and selected, according to their ranking position. For instance, co-designer X will give *n* points to the *efficiency* criterion for solution A, because in this case, it is said that " *the efficiency of the ball-bearings, it will not be so good* ".

As explained in the next sub-sessions, two types of problems occurred with these pre-established criteria: they are polysemic and they provide a narrow view of the process.

Problems with the polysemy of the prescribed criteria

We observed many problems when using the prescribed criteria list. First, the way in which these criteria were formulated was itself open to various interpretations. The participants found it difficult to agree on the meaning of such a criteria when it was time to rank the solutions and to select one of them. For example, *efficiency* could mean (i) *suitability of the solution* with respect to the process or (ii) *ease of installation* of the new equipment. This polysemy in the criteria led to some dissension and misunderstanding during the decision-making stage.

Problems with the restricted view of the process provided by the prescribed criteria

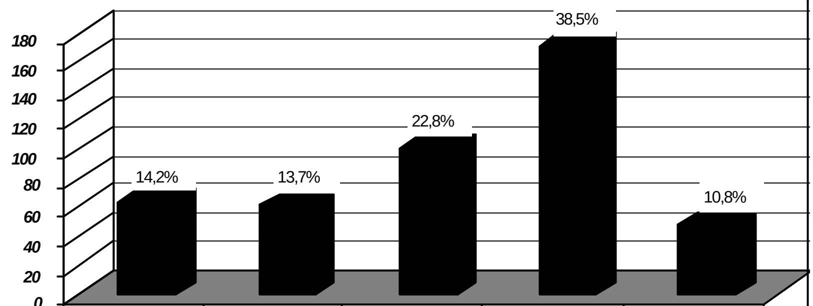
Another problem is that these prescribed criteria did not cover the set of criteria that were spontaneously debated during group meetings. Only 146 of the 444 occurrences of the criteria spontaneously expressed during the meetings (that is to say 30% only) belonged to the set of prescribed criteria. Some of the criteria spontaneously formulated were, among many others: *time, easiness, acoustics, ease of assembly, gestural easiness, strain, assembling frequency, handling, hardness, weight, posture, SMED rationale, quality, rapidity, task suppression, time savings.*

The "Spontaneous" Evaluation Process Is Based on Five Criteria Registers of Reference

These problems with the prescribed criteria used by the group for the evaluation of the new equipement lead us to analyze the whole set of criteria spontaneously formulated during the debates. The analysis of the transcripts reveals that the participants in the meetings were led, through the debates, to explore five different fields in which each solution would be applied. We call these “ registers of reference ” to stress the fact that the assessment of the solution refers to a set of complementary viewpoints from which the problems are analyzed and the solutions are thus judged (Garrigou et al., 1995; Blanco et al., 1996; Darses & Sauvagnac, 1997; Martin et al., 2000; Darses 2002). These registers of reference are:

- *Effect on the process* (eg, a solution would be rejected if the tubes are not straight);
- *Operating modes* (eg, a solution is deemed interesting because it eliminated the need for the adjustments and centring of rings);
- *Work conditions* (eg, the redesigning of equipment must lead to lighter physical loads);
- *Technical devices* (eg, the technical limits of solutions are judged);
- *The management of the SMED project* (eg, solutions were judged in terms of the cost and the return on the investment).

Figure 2 Proportion of criteria used for the evaluation of the solution (all meetings taken together according to the five different reference registers.



	Process	Project management	Technical devices	Operating modes	Work conditions
■ Number of criteria formulated within the meetings	63	61	101	171	48

We have categorised and sorted all the criteria according to these reference registers, as shown in figure 2 below. This shows how each reference registers contributes to the assessment of the solutions.

We see that the register of reference *operating modes* is strongly represented, (i) due to the objective of the design group (the redesigned equipment is to be handled during dismantling/assembly of the production line), and also (ii) due to the fact that the future users of the redesigned equipment (the manufacturing operators) are involved in the team. These two reasons explain why the operating modes are of crucial importance in judging the solution.

It is worth noting that all of the reference registers are used, although some of them only concern the participants in the meetings indirectly. For example, the register “ *Project management* ” is much used to assess the solution, although it mainly concerns the production chief engineer (who does not belong to the redesign group). We thus observe that all of the fields in which potential solutions could be applied are explored through evaluations, even those not closely related to participant’s concerns.

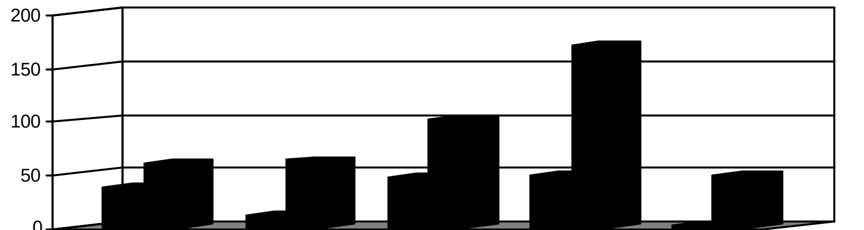
These results show that the participatory meetings foster the examination of the various registers of reference from which the solution is assessed. Individual viewpoints are enlarged and a systemic view of the problems is built when redesigning the equipment. Such a participatory situation brings together various viewpoints, for the purpose of recreating the system in which the continuous design objects take their meaning.

Comparison of the Use of Prescribed Criteria/All Criteria According to the Registers of Reference

We made a comparison of the use of *prescribed criteria* versus *all criteria* which were formulated during the meetings, according to the registers of reference they belong to.

The results, as shown in figure 3, point out that the decision-making process is implicitly performed on the basis of a much larger set of criteria than the pre-established ones. The proposed solutions, if evaluated only through the set of prescribed criteria, are thus assessed in a restrictive fashion. Moreover, the prescribed criteria list favors the evaluation of the solution regarding some reference registers rather than are others: *operating modes* are under-evaluated by the prescribed criteria, as are the *working conditions* and *process criteria*.

Figure 3 Use of prescribed criteria when evaluating the solution, compared with all the criteria formulated during the debates (all meetings taken together), according to the five different reference registers.



	Project management	Process	Solution	Operating mode	Working conditions
■ Prescribed Criteria	38	11	46	49	2
■ All criteria	61	63	101	171	48

Using Complementary Levels of Representation of the Solution

The analysis of the meeting transcripts has also highlighted that the decision-making process is far to be performed on the only basis of a functional representation of the problem. A *functional representation* is very close to the functional analysis formulation. It is supported by functional criteria, as for instance, *easiness*, *efficiency*, *reliability*, etc. It is worth noting that all the prescribed criteria are formulated on a functional level.

We show that the assessment of the solution is rather performed through *low level* criteria, these being *structural* and *operational*, as figured below (see figure 4). Most of the criteria (47,7%) are expressed at a *structural* level, focusing on the structure of the equipment being debated, i.e. the materials, forms, volumes, etc. For instance, the co-designers said "*the problem that we have with that is that bearings might give*" or "*that's going to leave marks on the tubes*", "*the crankcase must be soundproofed*", "*make sure that the height of the tank be adjusted*". The co-designers also use a large number of *operational* criteria, such as "*the problem with that is that you have to support the roller with your hand in an uncomfortable position*" or "*what's more, it'll need a nut*", "*it'll still have to be carried*". These criteria refer directly to the user's actions when using the equipment.

One of the most surprising results of this study is that the *functional criteria* which were expressed during the debates only represent a small proportion of the total criteria spontaneously expressed to evaluate the solution (27,5%).

This result stresses that the decision-making process relies much more on a concrete and instanciated view of the solution, than on an abstract and functional representation of the object to be redesigned. We could assume that this phenomena is linked to the fact that the members of the redesign team are not designers by trade, and do not master the "right" technique for design. But this result is in keeping with a number of studies (Visser, 1990; Nicolas, 1996) which have shown that designers, even during the functional phase, will tend to use a concrete representation of the object rather than a functional one.

Synthesis: Performing the Collective Evaluation Process on the Basis of an Expanded Set of Criteria

The cognitive analysis of how the evaluation is performed in the participatory design groups highlights that:the restricted set of prescribed criteria established by the chief engineer does not allow a full assessment of the solutions because of:

- the polysemy of the criteria
- an insuffisant coverage of the parameters to be evaluated.

The analysis of the whole set of criteria spontaneously formulated during the debates show that:

- The solution is assessed by the way of criteria which belong to complementary registers of reference, which are not equally represented within the set of prescribed criteria. This introduces a bias in the evaluation process, some of the registers of

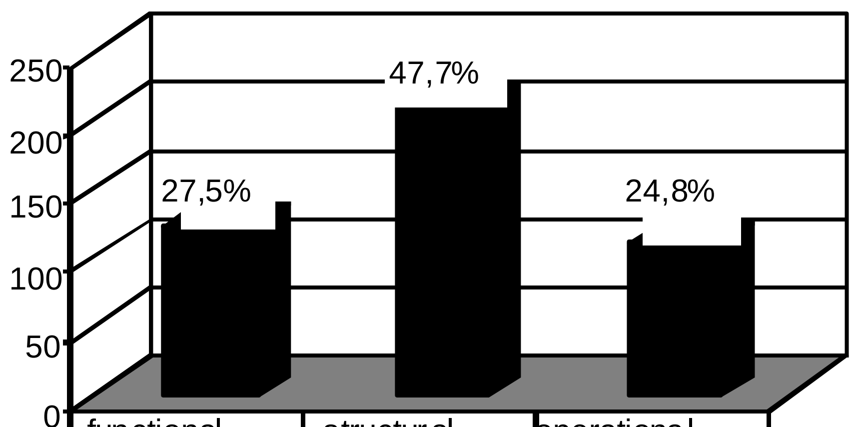
Thus, the assessment of the problem and of the solution requires the use of complementary levels of criteria, with a clear preference for the use of "low" and concrete levels of representation, as the structural and operatinal ones. This must be taken into account when conceiving participatory decision-making tools or methods.

reference being under-evaluated (especially here, operating modes, process and working conditions).

- The evaluation criteria are not homogenously formulated at an abstract level of representation (called functional level). This level is the one adopted by the prescribed criteria, whereas two complementary levels (structural and operational) do represent many other criteria.
- The solution is poorly assessed with the functional criteria, since these are very weak in accounting for the designers' representations: the co-designers mainly base their decision on concrete and operative criteria. Accordingly, the decision-making process, as based on a set of functional criteria, does not integrate all design parameters and restricts the decision sphere.

Accordingly, all criteria can be characterized along two complementary lines (figure 5). One line describes the register of reference to which

Figure 4 Level of formulation of the criteria used for evaluating the solution



	functional	structural	operational
Number of criteria	122	212	110

the criteria belongs, and the other line describes the level of abstraction in which the criteria is formulated.

These results have led us to build a new methodology for decision-making, which is presented in the next section.

Register of Reference		Functional	Structural	Operational
	Project management	It'll take a long time	That'll lead to a lot of work	
	Process	The efficiency of ht eball bearings, it is not so good	If we do this, it'll leave marks on the tube	
	Operating modes	The point is the speed of taking it down	The screws have to remain accessible	What's more, it'll need a nut
	Working conditions		You'll have to work on soundproofing at the same time	It'll still have to be carried
	Solution	It's just too costly to keep a straightening head like that	You'll need to make sure the height can be reduced	

Level of Abstraction

Figure 5 All criteria are classified along two complementary dimensions : (i) register of reference and (ii) level of abstraction

CRITERIA: A DECISION-MAKING METHOD TO SUPPORT THE PARTICIPATORY DECISION-MAKING PROCESS

The results presented above have led us to develop a participory design method called CRITERIA, which aims at helping collective decision-making. The rationale of CRITERIA is to foster the explicitation of the numerous criteria spontaneously expressed in the course of the design meeting.

CRITERIA's first goal is to scrutinize a wide range of reference registers. This forces to evaluate the solution on the basis of a comprehensive set of application fields. Thus, a systemic view of the design problem can be built and shared by all participants. In keeping with spontaneously expressed evaluations, the second goal of CRITERIA is to allow the explicit formulation of *complementary levels of criteria*, in order to avoid, as far as possible, functional judgements in favour of structural or operational judgements. The structural and operational criteria (eg. " guiding a piece, no aiming required, can be adjusted "), were grouped together with a related functional criteria (eg " system simplicity ").

As shown in figure 6 below, a grid was provided to the co-designers to be used during the voting phase of the participatory process. The issue is not to impose a tool or methodology that would serve to lay down the criteria at the beginning of the design process, but rather to provide the designers with one which would help them (i) to formulate the full set of criteria related to the solution and (ii) to negotiate their weighting during the development of the solution.

CRITERIA recommended three main successive stages[1], namely: (i) evaluate the problems encountered with the current equipment; (ii) propose solutions and justify them; (iii) choose the solution using the vote grid. Thus, by using CRITERIA, co-designers can assess the solution from a realistic point of view which is closer to their own comprehension of the process. At the end, CRITERIA improves the decision-making process, not only by increasing the *number* of criteria, but also by expanding the qualities of the criteria referred to. The collective decision has a better foundation simply because the arguments have been better and more widely scrutinized.

CRITERIA was produced to respond to specific problems in a specific industrial context. The participants in the redesign groups enjoyed using CRITERIA to select their solutions because it was a powerful tool for a systematic ranging of judgements. However, it appears that CRITERIA suffers some faults, which are the other side of its qualities. The maintainability of the method is problematic: the criteria, as soon as they are of low, concrete and detailed levels, are very much linked to the case and it is hard to use them in a generic sense. Thus, the adaptation of the grid to problems other than the redesign of tube production line equipment is quite costly. The second shortcoming of the

[1] The full CRITÉRIA method is presented in Darses & Sauvagnac (1998)

method lies in the weighting process of the criteria. These criteria, since they play a role of "design arguments", are negociated during the choice of the solution. This negociation was implicitely carried on by the participants, without solving the issue of participant's status in the process of argumentation. On this point, the improvement of the method could benefit of recent work being conducted in design rationale research (Moran & Carroll, 1996).

Evaluation of New Equipment from a PROCESS Point of View

Reliability	**Quality Risks**	**System Simplicity**	**Efficiency**
Can be corrected	Leaves marks on the tube	Equipment homogeneity	Adjustable pieces
Tolerance	Blackened plates	Guiding a piece, no aiming required	Detachable pieces
Does not impede production	Etc.	Can be adjusted	Less cumbersome pieces
			Losable pieces
Etc.		Etc.	Etc.

Figure 6 Excerpt from CRITERIA: Grid for Voting on Solutions at Different Analysis Levels

CONCLUSION

The research reported in this paper had two main objectives, namely (i) to understand and model, from a cognitive point of view, how evaluation and decision-making are performed during participatory design; (ii) to develop a collective decision-making method better adapted to the participatory context of the design process. However, the results highlighted in this study can be applied to any collective design evaluation process, even "non participatory", such as concurrent engineering or integrated team design.

The major role of concrete levels of representation of the redesigned artefact (structural and operational levels) is a point to developing collective design methodologies which would go beyond the traditionnal "functional analysis". Greater assistance must be provided to the co-designers for building a shared view of the problem and its context. These tools should foster the explicitation of implicit design arguments, and should support the negociation upon these arguments.

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Designing for an Ecological Agricultural Association – A PD case study

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ABSTRACT
In this paper, we describe a case study of the participatory design process of an information system for an "ecological" farmers association. It describes how the techniques of PD were applied and adapted to analyze its viability in the design of information and communication systems for complex democratic organizations.

Keywords
action research, participatory design, requirements analysis, democratic organizations.

INTRODUCTION
The principal objective of the experiment upon which this report is based was the design of an information system for an "ecological" farmers association. The methodology used was based on the adaptation and combination of software engineering and ergonomic techniques, and adapted the principal methodologies of action research, participatory design and of the pedagogy of liberation of Paulo Freire. More specifically, it sought to apply and adapt the techniques of participatory design (PD) in order to analyze its viability in the design of information and communication systems for complex democratic organizations.

The importance of this experience arose from the confrontation with difficulties during its implementation due to the complexity and peculiarity of the organizational context. In addition to a large number of members, and a lack of transportation infrastructure, electricity and telephony, the organization had been confronting frequent crises due to the risks and threats present in its surroundings. Since the members live at the mercy of superstructural factors, under the effects of globalization and barely democratic public policies, there was a need to make them competitive without losing the internal characteristics of solidarity, which is what guarantees the entity's existence. This demands constant changes in the organization and innovations in its productive and administrative methods, in addition to a constant search for new partnerships.

This article begins with a description of the organization, its context and its internal structure. It then relates the steps of the design process and of the implementation of the system and systematization and reflection about the experience.

THE CONTEXT OF THE DESIGN EXPERIENCE
Santa Catarina is a state in southern Brazil in which for historic and geographic reasons the rural region is dominated by small-scale productive structures such as family farms. This productive segment, despite its economic and social importance, has little political weight. It is dominated by family enterprises that have weak social and political networks and are poorly informed. These family farmers have a dependent position within agribusiness. The globalization process threatens to leave this economic sector unviable and cause the consequent intensification of rural exodus and intensity of poverty in rural and urban areas.

Concerned by these risks, various organizations have been working to guide and assist these families, and to establish a network which develops support programs for the various associative forms and/or collectives established by the agricultural families. The programs in execution are highlighted by those related to small-scale agribusiness; credit cooperatives, rural tourism, local development,

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agroecology, training and exchange.

These programs have achieved rather steady results and the sector continues to be able to attend the production demand for food and supply the state's agro-industrial complex. Nevertheless, this population is experiencing enormous difficulties and is entering a growing process of economic and social exclusion. On the other hand, to the degree in which these programs become broader, the need for more organization and administrative efficiency has become evident, as well as the need for communication to more effectively articulate the diverse programs.

In this context a group of professionals linked to NGOs and researchers at the Federal University at Santa Catarina created the AgroREDE project to provide structure to and implement a network of communication and information services which articulate the various rural social actors. The project works with a perspective of autonomous development in which "*autonomy is the capacity that the human being has to transform the world or environment in which he or she lives*" ([21], p. 182) and development is the process by which subjects achieve this autonomy.

In other words, the goal is for the actors to become capable of identifying the reasons to use the technologies and the transformation that they conceive as possible based on this use. This participation is promoted based on methodologies presented by Paulo Freire [9] according to which the themes and problems are codified and decodified based on the mediation of the intervenors, who are responsible for creating conditions for problematization and to challenge the community to become engaged in the process.

During this process, communities frequently demand more than information already available over the Internet. This was the case of AGRECO – Associação de Agricultores Ecológicos das Encostas da Serra Geral, [The Ecological Agriculture Association of the Slopes of the Serra Geral mountains]. AGRECO requested the design and development of its own information and communication system that could meet the needs of its structural organization. AGRECO currently establishes an association between family farming and sustainable agriculture – and bases all of its actions on a philosophy of solidarity, in an attempt to overcome the fragmentation and isolation of its members. The actions consist in the establishment of a set of principles and rules for sustainable production, the joint planning of production and in the associated commercialization of the products.

Created in September 1996 by 12 family farmers and colleagues in the city (professionals from NGOs and universities), it now has 220 associated small family farms. These families had been engaged in supplying the state's agro-industries through a system of mono-cultivation (production of tobacco or chickens), highly dependent on chemical and toxic inputs. This form of production generated a dependence of the producers on the large processing companies, in addition to degrading the environment and contributing to increased economic and social exclusion.

The growth in the number of members changed the profile of the association. It altered its initial structure in which tacit knowledge and verbal communication were sufficient to administer the generation and dissemination of information, for a more complex organizational structure. It is possible to envision this complexity by recognizing that the productive structure now counts on approximately 1,200 people organized in 54 nuclei (called condominiums) which produce 70 different products, some of which are processed in small agro-industrial companies.

Each condominium has administrative autonomy but produces and commercializes in an articulated manner. Production is organized based on the centralization of commercialization, or that is, the determination of what each condominium will plant and the quantity it will produce is made through an agreement reached in assemblies of the association. The production quotas of each condominium are defined based on sales estimates.

Since AGRECO is a not-for-profit organization, it does not purchase from the farmers at a given price and sell at a higher price to retain profit. It operates as a center that commercializes products in an articulated manner and socializes the losses and profits.

The *central* has an administrative structure equipped with telephone, fax and computers, and a staff responsible for receiving orders, organizing the harvest, delivery and financial management and accounting.

The tasks undertaken by the commercialization team are complex. Three times per week (because many products are perishable) production is collected at each of the 54 condominiums and delivered to more than 50 points of sale. The technical support to undertake these tasks was rudimentary and could not handle the complexity, indicating the need for implementation of a new communication and information system.

DESIGN METHODOLOGY

To implement the new system design methodologies were used that obey the principles of participatory design – PD, according to which users should be capable of making effective decisions about the role of technology in their activity. This requires that the specialists are capable of using, in the analysis and specification phase, representation systems capable of being understood by the community. Moreover, it requires that the communities affected by the use of technological devices have the right to say if they want their implementation or not [15, 10].

In addition it is understood that the use of this methodology can promote collective processes of technology learning and appropriation, constituting an emancipatory pedagogical intervention [9]. Thus, it was necessary to overcome the perspective that participation of the farmers in the planning would be conducted in a spontaneous form. As mentioned above, it is necessary to provoke and stimulate the explication and expression of the needs, contradictions, knowledge, conflict and more immediate interests of the community served by the conflict, in order to identify the social representation of this group about the possibilities to use technology in their personal, social and professional activities. That is, a research and work methodology is needed that favors and seeks this type of participation.

To do so an action research (AR) methodology was used [2, 24, 26]. The concept of Action Research goes beyond the naive vision that a researcher or extension agent does not have the right to, or should not, influence a reality. To the contrary, in action research, the researcher has the political commitment to act, but should do so in conjunction with the community in a participative and cooperative process. In AR as Thiolent emphasizes, there is a broad and explicit relationship between the researchers and the people involved in the situation being studied. This interpretation results from the order of priorities that are researched and from the solutions to be proposed under the form of concrete action.

During the design process, an attempt was made to establish a relationship between the traditional life cycle of software development and the development steps of the action research.

Pre-diagnostic – Problematization and Institutional Accord

In the first work phase, as emphasized by Thiollent (1996) and by Paulo Freire (1978), an attempt was made to recognize the community and reality, and to evaluate the opportunities for intervention [9, 26]. This evaluation initially consisted in verifying whether the leaders would resist the application of the principles of AR and PD. This resistance normally appears when the research is being conducted in an environment where there are strong hierarchical relationships and or difficult relationships between groups. Thus, an attempt was made to avoid that the results of the research intervention be used to maintain, justify, or incite asymmetrical relationships between the actors in the organization.

For this reason it was necessary to conduct a preliminary diagnostic of the situations and problems to be confronted. In this phase, an attitude of listening is essential. Participation should be conducted in the community with an attempt to identify and hear all the types of actors involved and the different interests and conflicts that are in play.

In AGRECO, this diagnosis was made through the participation in many forms of group meetings conducted in various decision-making arenas which comprise the association, such as the General Assemblies, meetings of the managers, of the technical team, of the group of assistants, of the commissions for commercialization and of production, of the Board of Directors, etc. In addition, the project participants spent much time with the farmers to accompany the entire production routine from the moment in which seeds were placed in the ground to the arrival of the processed products at market.

First, it was identified that the organizational structure of the Association was not stable, due to the rapid increase in the number of associates.

The initial conclusion was that the leaders of the organization tried to work with a democratic system to construct collective agreements. The *articulation work (*Anselm Strauss in [23]) was conducted by the majority of the leaders based on *worked agreements out* which were preferentially based on the strategies that include negotiation, discussion, education and persuasion and not on lobbying, manipulating, threatening, and coercion [1]. The use of non-democratic mechanisms was in general used by some sectors, which although they did not have a visible control (stance) within the rule-making structure (working-out work) [23], exercised a position of great influence and power on the primary work, which was conferred to them by the existence of asymmetries in access to the resources for conducting the work.

These sectors basically correspond to the groups of transporters and technicians. The transporters were the principal transport media of the information between clients and producers. This information was not subject to clear transfer protocol that allowed it to remain classified. They did not obey the rules that had been stipulated for the priorities of attending to the markets, and manipulated the response to client requests in order to obtain advantages that would increase their remuneration. Another sector that had access to privileged information was, because of its function, the group of agricultural technicians and the administrative staff. In both cases the invisibility [11] of the actions led to the impossibility of the application of the normative rules.

In addition, there was also great difficulty in maintaining the process of social interaction which gave support to the Association, because its complexity was making many aspects of the social exchange invisible, and leading to a loss of the common vision [21] which is essential for the maintenance of cooperative processes.

Since nearly all the interactions were based on verbal accords, and there were no clear collective protocol for registering information, nor a division of labor (since the Association was changing considerably and the roles of the actors were still not clear) there was a risk of losing mutual confidence and that the process would become paralyzed.

Another important finding of this pre-diagnostic was the fact that the actors in the organization, especially the farmers, already had identified these problems and demanded the construction of a computational support device to assist the cooperative work. Thus, the need of the farmers was aligned with the intention of the researchers to use technology to break asymmetrical power struggles to assure the principles and democratic ideals of the institution. These principles are those expressed in the design methodology used for *"If we want to change the power structures and flatten organizations then PD is appropriate"* ([14], p. 16).

The pre-diagnostic conducted allowed the construction of the terms of the accord between AGRECO and the AgroREDE project team. In this accord, in addition to the practical objectives, the ethical principles, the compromises and the responsibilities of the partner institutions were also expressed. The accord called for the implementation, based on a participatory process, of an information and communication support system for the organizational activities. These activities were at that time classified in two categories: primary work activities and articulation activities (following Anselm Strauss in [23]). The primary work activities include the **production** process – from planning, to planting, harvest and processing of the products – and **commercialization** - including receiving requests, the organization of collection of products and loads, delivery, billing and payment. In the second category were the **documentation** activities – the registration of the accords made between groups and the information required for the monitoring and support of the primary activities (such as technical visits, solicitations for raw material purchases, book-keeping, etc.).

Expanded diagnostic

After an evaluation of the pre-diagnostic and of the institutional and methodological accord of the action research by the administrators, an Expanded Diagnostic was sought. For this purpose the participation of researchers was intensified in the meetings and activities of the organization – simply as observers. Due to the democratic characteristics of the institution and the fact that the organization was undergoing a moment of historic transition, a number of deliberative meetings were held at the time at which the research began. There was no need to schedule specific meetings to address the issue of design. All of the meetings were recorded on video. In addition to the discussion, all of the members of the technical team, managers and some assistants were interviewed.

An activity that was especially important for the realization of the expanded diagnostic was the Strategic Participative Planning – PEP [3] which is now conducted regularly at AGRECO. PEP is a planning methodology that has the principal "those who do – plan". It can be said that PEP is a modality of a *future workshop* [18]. Three principal phases constitute PEP: the characterization of the organization, the analysis of the environment and the definition of the strategic questions.

In the first phase the characterization of the institution began at a general assembly where voluntary statements were made about the memories of important facts in the history of the organization. Then, working in a group dynamic and then in general assembly, the group began to define: What characterizes the organization? What makes it different from others? What are its goals? What are the values and principles that guide the organization in search of these objectives? Who are the different interested parties (groups of actors, institutions, individuals, etc.) and what are their interests?

Once the organization was characterized, the next step was analysis of the environment. At this time the risks and opportunities offered by the external environment, as well as the strong and weak points of the organization were analyzed and made explicit.

The last phase sought to define what are the issues considered strategic for planning future actions. A strategic issue is a question about what to do to be able to change a certain aspect of the organization. That is, in the strategic questions, the various actors make explicit their views of the future, in order to reach an accord about the changes that are collectively desired, and to indicate what will be required to undertake them. For each strategic question a short and medium term schedule was defined that included the required actions (already detailed at the level of activities), who those responsible are, and what is the origin of the necessary resources for the desired changes to be undertaken.

This whole process was conducted in four consecutive days of work. More than 100 people participated, representing various types of actors within the Association (founders, new associates, youth, elderly, technicians, etc.) The participation of women was still small. Participation was encouraged through various group dynamics (construction of scenarios, expression via design and diagrams, music, poetry, spontaneous verse, etc.). The entire discussion was registered in various work steps, each group had moderators and someone to write the report and various types of visual resources were employed (post-its, index cards, brown paper).

In the Participative Strategic Planning conducted in January

2001, five strategic issues were defined. Of these five, in four that will be described below, the implementation of the information and communication system was a priority and was defined as an urgent action:

- How to improve the participation of the members in the decision-making process of the Organization?

- What to do to promote the strengthening of the principles of equality of opportunities and distribution of income among the AGRECO associates?

- How to strengthen the behavior guided by principles of sustainable development?

- How to improve the organization and quality of production, processing and commercialization in order to meet growing demand?

Among the various activities indicated as necessary in the improvement of the information and communication system such as improvement of the telephone network, construction of murals, community radio, and monthly bulletins, the design of more than one information and communication system were considered essential.

In addition to the PEP, the researchers participated in various meetings of the production groups in order to design the information needs of the productive units. The strategy was to begin from the production and commercialization charts that had already been issued monthly. The difference between the delivery and the sale price is called the "split". The reason for the "splits" was not being specified on the balance sheets and had an important financial impact. For this reason the groups wanted to know where the "split" "occurred", and maintained that the balance sheet should give the reason for the "splits". In addition, they indicated that it would be more reasonable for the loss or "split" to occur in the field, and not after processing.

For this reason, proposals for new balance sheets that should contain more information were prepared during the meetings, on brown paper with magic markers. That is the farmers designed the spreadsheet that they would like to receive each week.

The researchers also participated in the meetings of the production and commercialization commission which sought to adapt the commercialization strategies to those of production, and reduce the "splits". In these meetings it was determined what the farmers had already indicated in the PEP: sales were planned without information about production and without information about the splits and the reasons for them.

It was also found that the absence of protocols for distributing the information made it possible for the transporters to control the information which they presented in a non-systematic manner (often verbally) such as information about production, requests and sales.

From the interviews conducted with the administrative technical personal, it was concluded that the most serious problems included the absence of an historic register of production (costs, quantity and quality); the excess administrative work load of the farmers in the condominiums; and the difficulty in communication – that is the lack of an organizational memory. Meanwhile, the assistants and managers had a perspective about the implementation of the system that was more oriented to planning long-term actions, such as offering direct contact between producers and consumers; a better quality democratic process, and a more precise and dynamic process for elaborating and monitoring of the rules.

The results of this expanded diagnostic was communicated to the team of technicians, to the managers and also at the board of directors meetings. The knowledge of these results had an impact in the community, even though the work was just beginning. The themes raised by the diagnostic began to be part of the rounds of conversation and of community discussions. This led to a search for strategies that could offer solutions to the problems. For example, the production and sales sectors began to think about new procedures for receiving requests, about rules for establishing priorities for service and for distributing demand between producers; while the representatives of the condominiums began to consider and suggest possible ways to estimate and communicate to the commercialization *central* the production estimates.

The first description of the System – Analysis of the Requirements

The diagnostic and problematization above gave support to the detailing of the requirements and needs of the system. This detailing was conducted based on the adaptation of methodologies from the field of ergonomics - a Hierarchical Task Analysis – HTA [5, 6, 7] - and software engineering - Use Cases of Object Oriented Analysis [16].

The realization of the broadened diagnostic certified for the AgroREDE project team that the decision to implement the system was demanded by the users (*users demanded)*. That is, it was not a *technologically pushed* decision. In addition, the fact that this diagnostic had been based on a qualitative methodology aimed at the social processes, allowed the perception of aspects of organizational reality that were not realized in an analysis aimed at the product – as is the case of the majority of methodologies of software engineering. In this way, even knowing the risks of adopting a methodology of analysis of requirements based on formal methods of software engineering, that are considered product oriented paradigms [8] as is the case of the Use Cases methodology, the project team decided to use it as a tool to mediate the design. It worked with the assumption that the fact that the use cases, in addition to being a high level design technique, can be described in natural language and are, therefore, a bridge between concrete use scenarios and the necessary formalization of the system, and thus allow good user-designer communication

The first step in the application of this methodology consists in having the design team define the set of use cases of the system. The need to communicate a general vision of the system to the users stimulated the organization of the use cases in a hierarchy, as determined by the Hierarchical Task Analysis methodology. The organization of the use cases in a taxonomy was based on their initial grouping and aimed at the processes and sub-processes of the organization (commercialization, planning and monitoring of production, documentation and management).

The use cases are a formal description of the future scenarios of the use of the system. To detail them it was essential to identify and classify the different actors who, because of their responsibilities, would interact with these use cases after the implementation of the system (the clients, the farmers or associates, the administrative staff, the technical coordination and the assistants.

The taxonomy of the use cases was validated at a meeting with representatives of the managers and of the farmers who are members of the Board of Directors. At this first validation meeting, it was not attempted to work with a description of the cases but to analyze the **extent of the taxonomy**, and to establish the **implementation priorities.** The priorities elected were the use cases related to the most direct support for the commercialization process now underway. For example the use case of “register client requests” was a priority over the use case “online monitoring of market stocks”. In this way, the taxonomy of the use case constituted an important tool for the design planning.

For each use case, **design** and **validation** groups were defined. **Thei**r attributions will be described later.

High-Level Design – Critical Analysis

After the definition of the use cases and the design and validation groups, work began for the detailing and specification of each case. This constituted a work of critical analysis of the UC problems. It is important to highlight that a use case, even one that is a priority in terms of implementation, is not always configured as a problem. For example, the registering of a product was considered a priority because it is a necessary condition in the implementation of the commercialization process, but does not resolve the problematic of commercialization and therefore is not a central design issue. In this sense, the use cases were then classified concerning the criticality of the problem situation in two groups: the strategic and the secondary. The secondary use cases were the object of detailed design in a later step. The step for design and critical analysis of the problem situations described in this section were conducted only for the UCs considered to be strategic. For these UCs the AR methodology was used once again.

1st moment: The expression of the daily representation of the problem:

The design group, which was small, was composed of people who knew the problems well, and who had the ability to construct their initial representation. This initial expression could be made in natural language, or by utilizing pictorial expression, construction of charts, diagrams or even dramatization. The designers could help with questions such as: What is the nature of the problem? What do we know about it? Where does it exist? Who is affected by it?

2nd moment: questioning the representation of the problem.

The representation of the problem made by the actors was then questioned. This was done through, for example, a use case scenario that allowed the identification of the points of view and the still not observed factors, the comparison of the information and the identification of the contradictions between different understandings of the situation, and the relationship of this with other use cases, etc.

This moment, was interlinked with the previous moment, for once the description of the use case was refined, the technical knowledge of the development team was confronted with the tacit knowledge of the actor who was specifying the description. This caused the actors to re-consider their reality and to propose to rebuild it. Then the design team prepared a narrative of the problem in order to explain what they understood of the description made by the users. During this process, other questions frequently arose about the use case. This process was repeated until a stable representation was reached of the UC.

3rd moment: reformulation of the problem.

Once a stable description of the episodes that compose the UC was obtained from the group, the design team prepared a presentation for the group to validate, forming commissions of representatives of users affected by the use case. This could be done through the construction of a prototype or a *low fidelity* “mock-up”. The prototypes allowed people to identify new strategies; to formulate hypothesis for action; to anticipate the evaluation of the implementation of the use case; and to differentiate the solutions of the immediate type and those planned for the long term, as well as those within the reach of participants and that required another type of intervention.

After passing through the validation group, the next step was to develop a high fidelity prototype, according to the reformulations proposed.

Detailed Design – The implementation of the joint action plan

After the high level design was conducted of all the strategic UCs that had been validated, high fidelity prototypes were developed. Once this was done, the implementation of the system (or part of it) could be undertaken. This implementation required an action plan that was coordinated between all of the actors, in the same way as the AR. It was necessary to make clear the new attributions of each party involved, as well as the implications of these attributions in the administrative and productive routines. Various meetings were held to create a task force to make the changes viable.

Evaluation or the PD as a permanent process

The PD and the AR do not terminate the programming and application of an action plan. The critical analysis of the reality and the realization of the actions called for in the action plan lead to the discovery of other needs and of other dimensions of reality.

In this sense, the action is a source of knowledge and of new hypotheses. The diagnostic, the critical analysis and the action thus constitute three moments of a permanent process of study, reflection and transformation of reality, which are mutually supportive.

These moments wind up unveiling aspects of the dynamic of association that have social and economic implications. The new factors that are perceived lead to a process of reflection that caused the actors to discover a set of new relationships between commercialization and their activity and raised various questions of a political nature.

It was clearly realized that the institution was undergoing a process of reconfiguration, the consequences of which could still not be foreseen. There is currently a demand from the farmers to modify the commercialization process designed by them at a first moment, in order to decentralize the distribution of responses to purchase requests by nuclei of the condominiums. In other words, the farmers want more contact with the clients and greater administrative autonomy, and are demanding that the association make viable the conditions for these requests.

With respect to the AgroREDE project, in order to understand and qualify the intervention conducted at AGRECO, new studies are being undertaken that should allow an evaluation of the social-cultural and organizational aspects implied in processes of aggregation of technology in rural communities of Santa Catarina state. This evaluation will be oriented by presumptions based on psychological theories that use an historical-critical approach.

CONCLUSIONS

The methodologies used in the design allow the evaluation and critical analysis of attending users' expectations and of the impact perceived in the implementation of the system to occur during the process. These evaluations point to some rather positive results.

The need to explain criteria, principles and organizational rules provoked by the detailing of the use case strategies led the members to change the way that they expressed these criteria, principles and rules, making more clear factors that previously mediated the relations in only a tacit manner and interfered in these relationships. This was the case of the process of clarifying the rules according to which would be socialized the losses from the production surplus. The critical analysis of the previously adopted rules caused the changes to be implemented, allowing a differentiated understanding of these rules and of the modes of construction. The level of understanding was such that it allowed retaking collective control of compliance with these rules – attempts to get around them were quickly perceived and made explicit.

This understanding was also manifest through the rise of autonomous movements calling for changes. For example, the administrative and commercialization modes that were considered centralizing are being changed. These movements indicate changes in the power relations.

Another aspect to be highlighted refers to the need for explication of the roles and functions of each actor at the moment of definition of the design and validation groups of the UC. That is, it was necessary to make visible and formalized the division of labor within the organization. At this time the technical team and the managers were made aware that this division of labor was tacit, and a problem. They then began a collective construction of an organizational chart. The validation of this chart, in addition to the explication of the roles of each actor, was an important factor for the organization and design of the system.

The use cases methodology, organized with a basis in a hierarchy, was the mediating tool that allowed the participative planning of the design. That is, the design and validation groups were defined based on the needs pointed to by the tools and interpreted in conjunction with the actors of the organization. The hierarchical analysis of the task helped the process of understanding the relations between the cases and facilitated the organization of the interface.

It was perceived that during the work there was an increase of personal confidence of the farmers concerning their ability to confront the challenge of operating a computer. This can be confirmed through the demand to equip the production nuclei with computers to allow on-line access to the commercialization information.

The organization was already experiencing a process of change at the time in which the design team began the work. This established an emergency situation and generated many expectations concerning the implementation of the system. This, in addition to the reduced size of the team and the lack of resources to pay for the design, often led to failures in the documentation process and frustrations – shared with the community – concerning the slowness of the process.

At the end of the process, it was concluded that the experience was a valuable training opportunity for the AgroREDE project team, which acquired experience with some of the basic factors in the application of participative design methodology, and is now prepared to repeat them. That is, the group systematized important elements needed for the construction of a methodology for intervention that considers the peculiarities of complex democratic organizations.

INFORMATION AND QUESTIONS

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Contextualizing Power in a Collaborative Design Project

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ABSTRACT
Power relations are a major concern in participatory design (PD). We explore how power relations are played out in a commercial collaborative design project that has not been influenced by PD techniques or interests. The case reconfirms many of the underlying principles of PD in handling power. At the same time, our Foucault-inspired analysis of the contextual dynamics and hidden power structures in user practices suggests certain extensions and improvements to the analysis of power relationships in PD projects.

Keywords
Collaborative design, Participatory design, Context, Power, Foucault

INTRODUCTION: CHANGING CONTEXTS AND POWER RELATIONS IN COLLABORATIVE DESIGN

> "Cooperative design certainly supports user participation. But the focus on process, action, and situatedness tends to disconnect the design process from the larger organisational context in which power is enacted. . . . The underlying belief is that . . . computer systems developed in a cooperative process have a liberating power. This is not always the case." [1]

In expressing their concern about the lack of emphasis on power, values, and politics, Bjerknes and Bratteteig articulate the point of view of the "traditional" Scandinavian particapatory design (PD) movement with respect to many current projects in collaborative design [2]. This point of view emphasizes that technology should be created democratically in projects with and for the users, with explicit emphasis on power, politics and democracy in the working place, accompanied by designers' purposeful coordination with workers e.g. [3].

However, not only has Scandinavian society changed since the days the trade unions first experimented with projects to develop democratic technology, but PD has also proliferated well beyond its original contexts. During this process, the border between the projects instantiating PD ideals and other collaborative design projects has become increasingly blurred. Projects with genuine PD interest have been conducted within the interests and constraints of industry cf. [4, 5]. At the same time many methods that originated from PD have become commonplace tools for the mainstream software (SW) design and industry cf. [6, 7]. The open source movement in SW development, "lead-user" method-based collaboration, "co-configuration", and increased emphasis on customer relations all point toward the proliferation of design practices that engage companies in direct collaboration with users. With irony it might be said that despite its "democratic ballast," collaborative design is well on its way to becoming a widely recognized approach in product design cf. [8] [6].

This historical development underpins our concern with what in the opening is actually meant by "the larger organisational context in which power is enacted" [1] and how it is to be accounted for. How do the "old lessons" fit the emerging way of doing collaborative design in commercial and product-oriented contexts? Should some of the wisdom accumulated in PD be supplemented or reconsidered in the light of the results of non-PD-informed design projects? In the following, we discuss our research on a multiparty design project that created a database program for diabetes professionals. We place particular emphasis on the benefits, losses and constraints for each of the partners involved in (or excluded from) the project. We attempt to explain these through an analysis of the power relations at play in the process. To gain more insight into power dynamics we employ Michel Foucault's genealogical research framework.

The structure of our analysis is the following. First, we

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introduce some of the key features of how power relations have been addressed in Scandinavian PD projects. We draw implications for how PD would inform collaborative design taking place between a commercial company and user sites. We then introduce Foucault's notion of power, after which we progress to our analysis of the design project and situate that project in the "meso-context" of other attempts to create and implement similar programs. In section five, we discuss the outcomes of the project for each of the participants and provide an account of how power relations affected the outcomes. We conclude with remarks on ways to analyze the contextual dynamics and embedded power relations that are present in design projects.

Our analysis is a result of a three-year case study from 1999 to 2001. As outside social scientists, we followed a multi-party design project from the launch of the first version onwards, and carefully reconstructed the events prior to the start of our field research. In addition, we contextualized the project under scrutiny with a historical study of all the previous attempts to develop diabetes databases in Finland. Our data was gathered through ethnographic observation and interviews and an analysis of the historical documents of both the user and designer activities. A thorough presentation and discussion of our methodological scheme and its theoretical background are available elsewhere [9].

2. Participation and power issues in participatory design

2.1. Addressing power in the collective resource approach and participatory design

In the following, we outline our understanding of some of the key characteristics of PD and discuss whether it has clear implications for the collaborative design projects in commercial contexts.

At the very outset, PD intertwined the issues of power and participation. Workers' participation in technology design was seen as a means to counter negative effects (the reduction of workforce, de-skilling, and reduction of the quality of work life) that management-deployed technologies often introduced [10]. These initial factors resulted in the emergence of a number of principles regarding participation and power. Fundamentally, PD, which was originally known as the collective resource approach, was primarily concerned with satisfactory work life as a source of well being and productivity, and, thus, was explicitly concerned with workplace development. The movement adopted an explicit "conflict perspective" on work relations. Instead of a consensus view, the interests of management and different groups of workers were assumed to be adversarial, *per se*. Moreover, workers were seen as being in a weaker and potentially oppressed position that could be strengthened only through the exercise of collective power through trade unions. [3]

These principles led to an array of further measures designed to firm up the principles. Efforts were made to come to an agreement with management about the project, and its objectives and long-term maintenance. Designers aligned themselves purposefully with the users and took it upon themselves to acquire an in-depth understanding of the work practices involved [11-13]. Efforts were made to place the negotiations on a democratic footing by ensuring that all the effected worker groups were represented in the design process. Following the conflict perspective, management or adversary worker groups were not allowed in the same design sessions if there was a chance that their presence would affect the other groups. During the sessions, emphasis was laid on ensuring that all the participants had an opportunity to express their points of view. Lastly, entire arrays of tools and arrangements were developed to provide the workers with means to understand the design process and have a true impact on it. The idea was that these tools would have to be relevant to workers actual experiences and thus allow them to comment on the details of the design, and envision how they would influence the work routines [3, 10]. Implicitly, the emphasis was laid on ensuring democratic processes within the design project, even though the prime threats were seen to arise from the society-wide political asymmetries.

2.2. Lessons that can be derived from PD for collaborative design in commercial context

The context in which PD was originally developed differs considerably from cooperative design projects involving users and a commercial company. Nevertheless, PD's background assumptions and methodological logic do provide some suggestions for the implementation of such projects. The most relevant to us here are:

First, judging from the issues addressed in publications on PD, the prime concern seems to lie in creating tools and means for participation that facilitate efficient and meaningful participation in the first place e.g.[14-17]. From this we conclude that adequate tools are of critical importance in a commercial setting as well.

Second, the conflict perspective would suggest that company-user collaboration is essentially a form of adversarial collaboration as well. SW producers try to maximize their profit, while users attempt to gain use value and minimize its costs by becoming involved with the development of the new technology. Successful collaboration assumes that the gained mutual benefits will outweigh the market contradictions. Nevertheless, as with manager-worker relations, a commercial company may dispose over vastly superior resources and power than any one individual user, thus leaving user partners potentially vulnerable.

Third, an important difference lies in the role of designers. As employees of the SW company, they cannot be assumed to align themselves with users even if they personally sympathize with users' perspectives. Our interpretation of PD is that without a formal agreement between the company and the user partners, users could be easily excluded from the decision-making process. This risk is emphasized by the vulnerability of participatory product development processes in corporate environments that are subject to ad hoc policy-making [18] [19].

A fourth major difference is that of workplace development and product development. While users seek to improve their working conditions and procedures, the company objectives are by no means restricted to success in any one individual site. While this clearly leads to an asymmetrical relationship between users and designers, the only implication from PD we could come up with is to regulate the interests of the participants with a formal agreement about the future of the project. Furthermore, our interpretation of PD is that neither the user partners nor the company should be automatically trusted to promote inclusive and meaningful democratic participation of all the affected parties.

3. The analysis of power in a collaborative design process and its context: a Foucauldian perspective

The later work of Michel Foucault offers an interesting framework for the analysis of power relationships in a design process. We believe that this framework may prove particularly fruitful in analyzing the contextual dynamics of collaborative design. Power in Foucauldian terms is not a commodity that can be possessed, transferred or alienated through, for example, legal acts and contracts. Power exists only in action and is employed and exercised through networks. In a network of power, individuals are simultaneously subjects and objects of power. In other words, "individuals are the vehicles of power, not its points of application" pp. 98 [20].

Foucault's genealogy of power draws attention to the productive characteristics of the power relationships of the modern world. Alienating and repressive power relationships are weak in comparison to the productive, "positive" exercise of power that investigates, creates and shapes things (for example, efficient and faithful citizens), and produces new knowledge (such as classificatory knowledge of the human body). Hence, strong power, also called disciplinary power, creates its own discourse, knowledge, identities, institutions and artifacts pp.106[20]. Foucault's well-known examples of disciplinary power mechanisms include the creation of modern prison and psychiatric hospital systems [21, 22].

Even though Foucault himself avoided simplified definitions of power, some definitions of a Foucauldian power relationship can be crystallized for the sake of clarity [23] cf. [24]:

1. A power relationship is present when the actions of one actor determine those of another.
2. A power relationship should be differentiated from an open conflict between actors.
3. A weaker actor is capable of making decisions and is able to rise up against the more powerful actor.
4. A power relationship is intermingled with other kinds of relationships, such as communicative, exchange-based and production relationships.
5. A power relationship may reinforce or modify a system of inequality.
6. A power relationship is dependent on the means that the actor in power can employ in order to create and sustain it. The means can be institutional (e.g. a hospital), rational (e.g. treatment guidelines) or material (e.g. a health care database).
7. A power relationship emerges from contingent local processes, from which it can expand and institutionalize generally.

Foucault's genealogy is not interested in *why* power is exercised but *how* i.e. what concrete mechanisms it uses. Foucault recommends an ascending analysis of power that starts from "infinitesimal" power mechanisms and investigates how these local mechanisms are expanded to more general systems pp. 99[20]. In this genealogy, the concept of the event is fundamental. Following Nietzsche, Foucault argues that "forces operating in history are not controlled by destiny or regulative mechanisms, but respond to haphazard conflicts" pp. 154 [25]. Consequently, the concept of the event has two characteristics. First, it is agonistic. Each event contains conflicts that should be analyzed in terms of their strategic developments and tactics. These analyses, in turn, make it possible to understand the contingent and hazardous nature of historical development. Contingency is the second characteristic of the event. Analysis of the details and accidents related to the events shows that the necessity of the historical development is only a retrospective attribution pp. 114[20], pp.114; [25].

We are now able to make some suggestions for applying a Foucauldian analysis of power to collaborative design processes and their contexts. First, power relationships should be studied in terms of activities that lead to the production of knowledge, artifacts, work practices and institutional elements. The emphasis of analysis should be laid on what Foucault calls strong power relationships and not only on weak and obvious power relations, such as repression. In a strong power network, a database may form an essential component. For example, the content and structure of a diabetes database effectively determine the work routines of a diabetes reception. Second, power relationships should be studied in the terms of conflicts, tactics, and strategic development. The approach should not be normative and operate on the basis of formal procedures of emancipation. This implies that it is harmful to use producer-user or employer-employee dichotomies as the starting points of analysis, as they may conceal the dynamics of a power network in which all positions are temporary and open to change. These dichotomies may also conceal diverse conflicts between actors, such as conflicts between different user groups. Third, the analysis should be ascending, starting from the local development and its details and accidents, before progressing to the expansion of the power network. For example, an information system, which forms a standard at the present time, should be studied historically from the beginning of its development. This may reveal contingent events and conflicts between actors who are not visible in the current practice.

4. Collaborative design in the wild: PDMS[1] as a multi party collaboration between users and a SW company

4.1. The outline of the PDMS development project

Some forms of user-designer collaboration are common in medical technologies. In such branches as the development and manufacturing of medical instruments, most of the new technological innovations are initiated by users [26, 27]. The likely reason for this is the restricted access and the privacy of medical settings. Designers often do not have sufficient knowledge of the needs of the medical practitioners [27]. As a result, it is common, on one hand, that medical practitioners search for an industrial partner to implement their ideas. On the other hand, technology companies hire medical experts to assist with their product development work. However, the collaborative design we studied, the PDMS project, is exceptional in a sense that it involved an extended network of collaboration between a SW company and number of users from various institutions and professions. The collaboration was born out of the complementary interests of the participants and involved no specialized skill, staffing or research involvement in collaborative design methods. Our own involvement in the project was restricted to the reconstruction and observation of the project until its 5th year, when we made two action-research oriented interventions [9].

The database was initiated by medical researchers of the department of Public Health and General Practice at the University of Oulu. They analysed manually over 100 000 patient sheets for diabetic retinopathy at the turn of the 1990's. As a follow-up study loomed in the future, they were eager to computerize the patient records. A municipal diabetic clinic joined the pursuit, as they wanted to have a statistical tool that would make it easier to follow the treatment balance of their patients.[2] With the help of a programmer from Oulu University Hospital, these users created a preliminary database with Microsoft Access.

In 1996, a small SW company, ProWellness Ltd, was founded in Oulu to create an Internet-based archive for medical records. The city of Oulu recommended that the parties should engage in collaboration. ProWellness saw diabetes as a good starting point, while the users saw promise in the expertise of the cutting edge programming firm. While users provided the details of diabetes care and practice, the company brought their programming skills and their experience in designing programs and databases for time-pressured work.

In the first phase of the design collaboration, both parties came to an understanding of what information should be included in the database and how it should be handled. The contents were solely specified by the users, who also spent time in educating the designers about diabetes treatment and the details of their work. The structure of the program evolved in the course of the collaboration. The main form of collaboration was ordinary, albeit intensive, communication with users and designers. Ideas were exchanged in face-to-face discussions, e-mail, as well as in simple hand-written notes and drawings about the data contents and potential interface solutions. The ideas were iterated first on paper and then worked into prototypes that were tested and developed further. The designers made the final decisions about how to incorporate the various features, however, their decisions were wholly dependent on the expertise of the medical participants. All in all, the parties were mutually dependent on the complementary resources of their counterparts.

The collaboration also quickly refined the goals of all parties. The company realized that their original archive idea had been too ambitious and too difficult to realize. Their business idea was refined into creating PDMS-like expert systems for other long-term illnesses in connection with developing citizen's self-health programs for these diseases. Users appreciated the idea that, using Internet technology, the database could be filled in by all key personnel and would facilitate coordination between the various physicians, nurses, auxiliary nurses as well as the

[1] PDMS is an acronym for ProWellness Diabetes Management System, in which ProWellness is the company involved in the design process.

[2] Diabetes is an incurable long-term illness. In the longer run it leads to, for instance, kidney failures, heart attacks and blindness. These complications can be countered by maintaining "a good treatment balance", mainly right blood-sugar level, with diet and medication. A large amount of documentation is produced and used to control the disease over the years. For this purpose, paper forms have been the main tool, currently sought to be replaced by SW.

specialized care given in the local hospital. Additionally, the company envisioned an additional module for the home use of patients. In this way, the database program grew to incorporate all the data generated in the treatment and monitoring of diabetes. The first part of this program was the physician's and nurse's screens that were piloted and further improved in the Oulu diabetic clinic beginning in 1998.

In this early period of collaboration, participants managed to create tools and some good procedures that facilitated efficient collaboration between them, even though none of the participants were aware of any PD or user centered design (UCD) methods. However, we must remember that the users already had a history of trying to create their own applications and thus had some experience in how to computerize their work practice. Nevertheless, this goes to show that in certain conditions, in-depth user-designer collaboration can indeed be accomplished even without specialized means. The success of the project also shows that collaborative design is a feasible way of working for a commercial company. Had the company tried to gather all the knowledge needed about diabetes by itself, it would have traveled a long and rocky road.

When the first version was up and running, the collaboration network was extended with the help of the professional contacts of the users. The new participants were physicians and nurses in the diabetes clinics in the central hospitals of Tampere and Kajaani, who were giving special care to diabetics. This extended collaboration also proved successful. In two years, the specialized needs of the personnel in special care were incorporated, and the usability and statistical functions of the program were significantly improved. During the year 2000, the program was bought by a number of hospital districts in Finland and the new user sites were incorporated into the development team.

At this point, when the co-design work had been going on for four years and the program had gained a promising market share in Finland, tensions and significant problems arose in the network of collaboration. First, while the database had established itself as a *de facto* standard in Finland, being used in the most major hospital districts, it was not being used in any normal health care center in these districts. The expert network developing PDMS saw its use in health care centers as a matter of motivation and training. The collaboration was not extended to regular GP's and nurses, as the conglomerate believed they knew what "has to be in the program". Nevertheless, the primary health care seemed to shun this conviction by simply not accepting the program.

Second, instead of the previously swift action to incorporate new ideas for improvement from users, the company took a reserved stance towards the various wishes for customization and new features that were voiced particularly by new user sites. It became apparent that the company took the view that the program was essentially ready, and it accepted only those changes that were absolutely necessary. In Part, this shift in attitude occurred because the resources of the company had shifted into the internalization of their business and into making end-user programs for patients with long-term illnesses. In addition, the management in the company had partially changed and the new products were now being developed "with the leading experts" instead of a multi-professional collaboration. The company also believed that they, meaning the company, were the ones who know how to develop databases for illnesses, particularly for diabetes.

At the same time, the medical practitioners considered the PDMS program to be expensive. Even the early developers had to pay handsomely for the program they had been developing. Moreover, the work that users had put into the development work was acknowledged only with a brief and anonymous referral, "developed in collaboration with users". To us outside observers it seemed evident that something had perhaps started to go wrong there, and that bigger risks might be looming in the future of the project.

4.2. The PDMS project in the context of developing diabetes databases in Finland

As illustrated by the quotation that open this paper, one of the implicit characteristics of PD has been its focus on individual design projects. Even though the Scandinavian PD tradition has emphasized the over-all sociopolitical context in which design takes place, also here the practical implementations have mainly been restricted to individual sites. Perhaps not coincidentally, there is astonishingly little analysis of the dynamics of the sociotechnical "meso-level" context of a particular PD project.

During our PDMS study, we noticed that some of the user partners had also previously been developing diabetes databases. When we started to inquire what had happened to these projects, we found ourselves unearthing a "graveyard of withdrawn diabetes databases." There had been numerous attempts to create diabetes databases in Finland and almost all had foundered.

This led us to map out all the hospital districts in Finland to find out how these projects came about and what had caused them to fail. Our interview round revealed that in 11 out of 20 hospital districts in Finland, a total of 21 programs had been created since the mid 1980's (excluding PDMS). Only four of those programs were still in use when we conducted our interview and their use was not about to end in the near future. In none of the cases had the use proliferated beyond the district where the program was developed. However, these projects to develop and maintain a database were not futile, random or without effort: in 13 cases the program was used more than three years. Nevertheless, in practice, the patient information usually had to be entered during patients' visits and it took several years to gain enough coverage and depth of in the database to achieve significant benefits.

What had motivated these numerous attempts? In our interviews, it became clear that the doctors and nurses lacked tools to follow how their patients were responding to treatment. More specifically, it was unclear how the "treatment balance" of the patients, particularly the blood-sugar level, was being sustained in the longer run. This made it even more difficult to know how the patients responded to treatment including diet and medication changes that became necessary with the advancement of the disease. At the same time, the number of the diabetics continued to increase in the aging and increasingly overweight population. The attempts to develop database programs can be seen to derive from this prevailing contradiction between the demand to gain control over the complex, proliferating and expensive disease and the insufficient tools to handle information that was crucial for its treatment.

Who then developed these programs? Out of the 21 units having a database 17 had been involved in its development. In only two cases had an individual physician pieced the program together. All other projects were more or less collaborative, usually including a number of doctors and nurses from the unit where the development work was done. In roughly half the cases, the programming expertise was acquired from the computing department of the hospital. There were also two cases in which outside consultants or a software company had been involved in the development work. It is remarkable that in most cases the developers were not aware of the other database projects, even when some hospitals have hosted multiple projects in different clinics and periods. In only one case was the collaboration extended to multiple units in one district. All in all, one can characterize the projects as mainly collaborative and user initiated, yet they remained isolated attempts to come in terms with the same problem.

Why, then, had the attempts failed? To answer this question two aspects have to be considered: the reasons for abandoning the programs, and the dynamics that had led to the abandonment. Table 1 summarizes the main reasons our interviewees gave for abandoning the program.

Table 1 Reasons given for abandoning of the use of databases in the 14 units in which the use had stopped altogether. (In some places there were multiple key reasons).

Reasons given for abandoning the use of a program	
The active user developer left the health care unit	2
Hardware or programs had become outdated	3
The database had been replaced by another program	1
Program use was not seen as useful or bringing benefits	3
Changes had occurred in the organization	2
Problems had interfered with the usability of the program	8

In the same way, the reasons for continuing the use of the remaining seven programs are summarized in Table 2.

Table 2 Reasons given to the continuation of use of the databases in the 7 units in which a database was still in use (including also those 3 units where its use was about to end or there was only one active user).

Reasons given for continuation of use	
Enthusiastic user developers	5
Waiting for a new program (saving the data)	1
Complementary use of the database and paper forms	3
Good usability	1

As illustrated by the tables 1 and 2, there are a number of common reasons for abandoning a program, such as organizational transformations and technical obsolescence. Nevertheless, by far the most usual reason for the abandoning the program was problems that we have classified under program usability. The most important problems we classify under usability are the following:

a) The program was too complex for daily use
b) Manual filing and updating the patient data was slow and tedious
c) Logging in to the program and simultaneous use of other programs was difficult
d) Operating the program was too slow and difficult owing to the hectic pace of reception work

In only one case did the ease of use support the use of the program. When we inquired into the structure of the programs, we discovered that they were built to comply with care recommendations and to incorporate as much data as possible. These features were particularly desirable for the diabetes specialists and their interests in research and population level management of the disease. The more exhaustive and accurate the information, the more could be inferred about the disease.

From the perspective of daily patient reception, however, the aim for exhaustive data led to complex structures and required more tedious operations in program use. Frequently, the information had to be filed into the database outside the reception hours, often at the end of the day. Slowly the problems in usability then led to declining interest in the program. While this led to the outright abandonment of the program in 8 out of 14 cases, similar problems were reported also in a number of the other programs as well.

The dominant role of the enthusiastic user developers was emphasized among the reasons for continuing the use of the program. By user developer we refer to a doctor or a nurse who was active in the development of the database and then an enthusiast in its use. Their motivation in holding onto the program seemed to be a factor that made up for the mundane difficulties. With one positive exception, the programs still in use resemb le the abandoned programs in regard to ease of use and their fit with the work routines. They require significant inquiry and effort from their users in the daily medical practice.

To conclude, one of the main motives for developing diabetes databases was to gain possibilities to make inquiries and to do diabetes research. However, this interest seems to have resulted in programs that do not suit the daily work in the patient reception. Aiming for exhaustive information seems to hinder the use of the programs, and has continuously prevented their proliferation. In many cases it has also led to their abandonment in the initial location.

These results indicate that the problems in PDMS not only stemmed from relations inside the particular project, or that they only reflect general societal laws governing the interaction between certain positions held in capitalist society. There seems to a similar ending to every story, no matter whether the systems had been created solely by the IT people, only by the users, or in collaborative participation. We find results of this kind indicative of long-term dynamics at play within the sociotechnical processes involved in designing diabetes databases.

5. Power relationships in collaborative design

5.1 Producer–user power relations in the PDMS project

In this chapter, we analyze the PDMS design project from the perspective of power and employ some concepts of Foucauldian genealogy. Obviously, the PDMS design project was based on productive power relationships. In the collaboration, the firm and user participants were self-governing and capable of making their own decisions. They joined in collaboration in order to accomplish their own interests and agendas. The interest of the firm was to achieve a competitive health care in formation system by utilizing cutting-edge Internet technology. Besides the potential financial profit, this interest derived mainly from the developers' previous experience in designing health care information systems and other databases.

The user partic ipants' desired to achieve an information management system that would monitor the quality of care, put the care recommendations into practice and produce data for diabetes research in municipal and hospital diabetic clinics. The user participants did not get any financial profit for their time and efforts.

The early phases of producer-user collaborations were beset with contingencies, whereas in the later phases the firm planned its collaborations more systematically. It was accidental that the developmental paths of Prowellness and the municipal diabetic clinic of Oulu converged at a certain point in time. The hospital diabetic clinics were missing from the early cooperation, but the firm recruited them in the later phases. Prowellness changed its collaboration tactics radically after the program became the de-facto standard for diabetes databases in Finland. The firm started to develop similar kinds of databases for other chronic illnesses and sought to open international markets for its products. It abandoned its old way of collaborative design when the number of the user sites grew and the cacophony of their wishes and demands became difficult to manage. The firm started to recruit, exclusively, the leading domestic and foreign medical professionals. The autonomous collaborative design, in which a whole working community was involved, proved to be a limited period in the company's collaboration strategy. The company's rationale was straightforward: collaboration with the leading professionals convinced the buyers of medical databases more easily. The involvement of the former user partners diminished as the firm ceased to incorporate their wishes. Nor did they gain any credit for their past efforts. The firm in turn, had gained a significant amount of free expertise in diabetes care and care practices in general, co-design help in achieving a working program, thorough in-site testing in a number of locations, good references and often direct help in marketing the program as well as good contacts with health care professionals and decision makers in regard to their coming products. The asymmetry between the benefits for the partners is striking.

5.2 Power relations between users, and the firm's role reconsidered

When we look at PDMS only at the project level, it was possible to balance the power embedded in the knowledge of design on the one hand and hand-on experience in medical treatment on the other. Eventually, however, the firm was able to terminate the mutual dependency and tilt the power relation to its own benefit as soon as it had acquired the knowledge it needed. In another words, while formalized PD methods were not necessary in producing a successful co-design, the cautionary lessons about power relations in Scandinavian PD proved more than adequate in this commercial context.

Nevertheless, when we look at the project in the context of diabetes treatment and its database development, we come to perceive that the immediate producer-user power dynamic was but one of the significant power relations at stake. The graveyard of the abandoned databases bears witness to the fact that the programs were created according to alignments in the power structures in diabetes care. The databases were developed and used as tools to control the quality of the care given, and to aid in the production of care recommendations and research results.

In comparison with paper-based methods, an electronic database imposes significant constraints on the ways practitioners can act and register information in their patient work. It also improves the ability to monitor their actions. The work routines and arrangements in patient reception vary from one location to another. What is common, however, is that while papers allow more freedom to the way practitioners work, the paper-based work is so firmly embedded in procedures, artifacts, division of labor and coordination that computerization could not enter work routines as an add-on. Computerization almost inevitably causes routines to become more constrained, and local practitioners resist this loss of flexibility and the resulting extra work (see also [9] on the ethnography of the work routines). Usability problems are precisely indicative of the poor fit with the needs of the users. Thus, the database graveyard can be seen as an indication of the conflict embedded in this kind of attempt to crystallize power relations in using.

When we look at PDMS, we notice that the power dynamic among the users was very much the same as in the previous projects. PDMS was designed by the enthusiasts and was made (even more) far reaching in coordinating and enforcing the specialists' way of treating the disease. The wide user participation and skilled programmers were key factors in negotiating and resolving the conflict between the care recommendations and work routines that is inherent in the program's functioning. Most professional groups and stations in special wards were satisfied with the result. Yet, again the battle line remained, only this time with local primary care health centers. The feedom negotiated for work routines by the advanced structure and interface design of the program was not enough for primary care. The benefits from the program use did not compensate for its poor fit. Interestingly enough, it seems that the specialist participants in design were not consciously aware of the conflict and hence saw no reason to consult people in the "lower" level units of medical hierarchy. Their resistance was, and still is, seen as unfortunate and as showing somewhat irresponsible disinterest in the issue.

ProWellness joined the project unaware of the internal tension between the treatment guidelines and the practice of diabetes care. During the design process, the company was subordinate to specialists' views of the program. Through the company, specialists gained a way to further a number of their interests. First of all, with their programming expertise the company provided a way to overcome local work routines by creating an attractive standard means of recording the data. Moreover, the company provided outside expertise to maintain and update the program in the long-run, thus securing and externalizing the standardization of work practices. The company's search for cost-efficiency pointed towards a single standard matched also the wishes of the specialists. At the same time, the resources of the company were needed to overcome the numerous problems that were bound to arise with the effort to transform the existing local information and bookkeeping systems. Most importantly, company resources for selling the program for primary care (primarily, to the managers of primary care) was most welcome to the specialists. It should also be noted that even if the company did not formally acknowledge the users, their professional colleagues were well aware of who had been active in the PDMS project, which was all that really mattered.

To conclude, when the project is seen in the context of the broader power dynamics in diabetes care, we notice that the user partners were far from being defenseless, or that they derived no benefits from it. Rather we see a shift in the power relations during the project as the company gradually gained independence from the user partners by realigning itself with individual experts.[3] At the same time, it became ironically clear that the excluded parties, the non-enthusiastic and non-specialist primary care GPs and nurses are the ones whom the specialists sought to subjugate. While diabetics are but a small fraction of the patients of these professionals, most diabetics are nevertheless treated by them. From the perspective of non-specialist GPs and nurses, the company sought to re-allocate their tight resources to the expensive program, while the specialists sought to reorganize their work routines by adding procedures that mostly benefited the diabetes specialists. At the end of the highly collaborative design project, the fate of the product depended on whether the ones excluded and sought subjugated would have to accept these

[3] It is noteworthy that even in its realignment from the locked-in partners, the firm was entrenched in the power dynamics of medical practice in other ways. The purchasing decisions in the medical settings rely on the expert opinion, and thus the company had to realign itself with experts.

alignments, or alternatively, whether they would turn their backs on the use of the program. In the best case, there might be a possibility to interest the company and other user collaborators to reformulate the program in the hopes of adapting it to suit the previously unvoiced requirements.

5.3. How to study the power networks of collaborative design projects: the impact of researchers

The PDMS case shows how well-intending and highly collaborative design projects can, in fact, end up promoting systems of inequality. Without a historical perspective, the user partners, designers, companies, or outside researchers for that matter, can support or even strengthen the existing power relations and dominations, such as one user group's dominance over another user group. How, then, can power networks be recognized and approached? They are hard to discern without a historical analysis, which requires multiple research perspectives and a focus on conflicts. Second, ethnographic study of the user sites, which were silent during the design process, is a beneficial means of gaining access to these networks. Nevertheless, incorporating the ethnographical findings into the ongoing design process may prove difficult if the design process is in its final stages from the perspective of designers, as we found in the case of the PDMS. Third, we recommend researcher-driven interventions, where issues of power and exclusion of some user groups are discussed with the research subjects, even though their impact might be restricted. In our case, the dominant users also dominated the terms of the intervention seminar (for a more thorough discussion see [9]).

6. Conclusions: Understanding and analyzing the contextual dynamics of a collaborative design project

We have elaborated on the context and power relations in a collaborative design project that took place in commercial and product-oriented environment. Partially related to this, we inquired into the effects of the "meso-context" where design projects take place. By using Foucault's analysis of power, we hoped to gain insight into how the PD's principles and guidelines regarding power relations fit these concerns.

The first significant finding was that in non-PD informed collaborative design, the specialized participatory design methods may not pose the trickiest challenge for the co-design. The project was able to mediate the transmission of expertise between the participants with relatively simple communication and co-design tools. It was the power and interest issues that ultimately posed problems to the success of the project.

Our analysis of the individual project seemed to repeat the lessons derived from PD: the power relations between the company and users proved asymmetrical. The company disengaged itself from the collaboration as soon as it had a commercially viable program in its hands. Users' interests in further development and customization of the program were left unfulfilled, and they had very little means to bargain for changes or to renegotiate the price, which they found expensive.

Our historical analysis of the long-standing power relations, or sociotechnical "meso-context" of diabetes care and its databases, showed that the an individual project may be a misleading scope of analysis. We found that previous diabetes databases had ended up on the scrapheap regardless of their location or how participatory they had been. There was an enduring conflict between the care recommendations and requirements of patient work. This contradiction was based on the power relations between the specialists and local health care personnel and crystallized into the structure of the database programs. The databases constituted an essential medium for the establishment of a productive power network in diabetes care. This was the case also in the PDMS project, which, despite the seemingly broad and democratic user participation (both primary and specialized care units were represented), ended up disregarding the participation and perspective of non-specialized diabetes treatment. In this way the company became entangled in user partners' power interests, which were to a great extent fulfilled in the project. When we presented our results to the project participants in a seminar, it became clear that the power dynamic was invisible to all the participants in PDMS project, even though they agreed with our analysis. From a Foucauldian perspective, this should not be surprising. Individuals, artifacts and projects often come to embed power relations without being aware of them. In diabetes care, the inherent contradiction was obscured by the seeming joint objectives of all parties involved in treating the disease.

When comparing the lessons offered by PD and our Foucault-inspired power analysis of the PDMS project we see a number of similarities and differences. First of all, both emphasize the importance of becoming aware of the effects of implicit power relations. The hope to achieve harmony among the different worker groups, producers and users (or management and workers for that matter), proved to be a misleading as a guiding principle for collaborative design. Design crystallizes power relations, and it can either resist or further the existing power structures. PD's conflict perspective promotes awareness of these dynamics by raising power-related issues into the foreground of project work.

Nevertheless, Foucauldian sensitivity to power suggests, as in the PDMS case, that it may be difficult for the participants in PD and cooperative projects to recognize the contextual dynamics that are at play within particular users, organization and technology production constellations. In other words, there is no guarantee that democratic participation can reveal and balance wider, historically-formed power structures affecting a design project, or that formal agreements help in preventing unwanted effects. The crucial issues must first be known before they can be negotiated. Without awareness of the dynamics, well-intending designers and researchers may implement technical solutions that support and further the systems of inequality and subjugation. Such linkages are hard to discern without historical analysis that can reveal recurrent dynamics and hidden developments in work practices. In our case, such an analysis also served as a basis for our intervention and ethnographical study, which we used to make the voice of the silenced and subjugated audible cf. [9]. Their importance and needs are often the ones that will determine the success or failure of the technical project.

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Using Pattern Languages in Participatory Design

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ABSTRACT

In this paper, we examine the contribution that pattern languages could make to user participation in the design of interactive systems, and we report on our experiences of using pattern languages in this way.

In recent years, there has been a growing interest in the use of patterns and pattern languages in the design of interactive systems. Pattern languages were originally developed by the architect, Christopher Alexander, both as a way of understanding the nature of building designs that promote a 'humane' or living built environment; and as a practical tool to aid in participatory design of buildings.

Our experience suggests that pattern languages do have considerable potential to support participatory design in HCI, but that many pragmatic issues remain to be resolved.

INTRODUCTION

The pattern language concept was originally developed, by the architect Christopher Alexander and his colleagues, both as a theoretical account of the properties of a humane, or 'living', built environment [2, 3, 5] and as a practical tool to aid participatory design processes [1, 4]. Patterns and, to a lesser extent, pattern languages have been widely adopted within software engineering as a form for sharing knowledge about 'good' design solutions between professionals [15], but the approach to patterns adopted in software engineering has ignored the participatory aspects of Alexander's original work.

In recent years, there has been a growing interest in the use of patterns and pattern languages to support human-computer interaction (HCI) design [8, 9, 31]. Much of this work has been inspired by the perceived success of patterns in software engineering. Of course, the parallels between architectural and interaction design, with their common concern for the design of the human environment, are arguably closer than those between architecture and Software Engineering. This may suggest that the benefits of developing pattern languages in HCI may be even greater than in Software Engineering. However, the approach to pattern languages adopted within HCI has followed closely that of software engineering, with the emphasis on sharing knowledge between professionals rather than on processes to support user participation in design. For example, the definition of a pattern language generated at the Interact'99 patterns workshop states: "The goals of an HCI pattern language are to share successful HCI design solutions *among HCI professionals*…" (our emphasis, as quoted in [9, p39]).

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In this paper, we report our experiences of developing and evaluating pattern languages as aids to participatory design of web-based systems. From our studies we have identified a number of important issues that require further examination. These issues may also be of interest in other contexts where externally produced design advice is being used within a participatory design process.

Structure of this paper

In the next section, we introduce the concept of patterns and pattern languages as used in architecture, software engineering and HCI. We then describe the approach we are developing for using pattern languages in practice and how it relates to Alexander's approach. We then make a number of observations both about the form of pattern languages and practices using them derived from our investigations. Finally, we discuss relationships with other work, and issues we hope to address in the future.

PATTERNS AND PATTERN LANGUAGES

Pattern Languages in Architecture

Alexander introduces design patterns as follows:

> "Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million

> times over, without ever doing it the same way twice" [2, preface p. x].

Alexander's pattern language includes patterns addressing different physical scales ranging from the distribution of cities [2, pattern 1], the organisation of communal space, e.g. 'Access to Water' and 'Accessible Green' [2, patterns 25 & 60], through to patterns addressing detailed structure in individual rooms, e.g. 'Windows which Open Wide' and 'Alcoves' [2, patterns 236 & 179]. An intermediate level pattern is 'Light on Two Sides of Every Room', for which the problem and solution are stated as:

> "**When they have a choice, people will always gravitate to those rooms which have light on two sides, and leave the rooms which are lit only from one side unused and empty.**
>
> …
>
> Therefore:
>
> **Locate each room so that it has outdoor space outside it on at least two sides, and then place windows in these outdoor walls so that natural light falls into every room from more than one direction.**"
> (2, pattern 159, authors' emphasis)

For "convenience and clarity" [2, preface, p. *x*], Alexander defined a specific textual and typographical format for the presentation of a pattern, consisting briefly of: a name and reference number; a picture showing an example of an instantiation of the pattern; a paragraph to set the context; three 'diamonds' marking the start of the problem; a concise problem statement (emboldened); the body of the problem, including the empirical background (the motivation for the pattern) and the 'forces' involved in the resolution of the problem; a solution (emboldened and preceded by the word 'Therefore'); a diagram to illustrate the solution; another three 'diamonds' to mark the end of the problem; and a paragraph indicating how this pattern relates to other 'lower' patterns in the pattern language. Important features of this format are:

- the combination within each pattern of both abstract descriptions of the solution (in text and graphics) and an illustration of a concrete realisation of the pattern;
- the inclusion of explicit advice recommending a specific built form, rather than simply stating desirable properties of a 'good' solution;
- the combination of both the problem – solution pair (emboldened) together with text providing a rationale for the particular solution recommended.

Patterns within the language are related in a hierarchy with larger-scale patterns indexing patterns at smaller scales that can be used in their realisation. In [2 & 3] Alexander develops an explicit analogy between the concept of a generative grammar for natural human language and pattern languages in architecture:

> "both ordinary languages and pattern languages are finite combinatory systems which allow us to create an infinite variety of unique combinations, appropriate to different circumstances .." [3, p187].

The parallels between natural languages and pattern languages also relate to the way that Alexander understood the evolution and development of pattern languages. Alexander viewed pattern languages as shared cultural artefacts, reflecting the practices of the communities that developed them. He interpreted the development of design languages by professional communities, in ways that excluded the users of buildings, as part of what he viewed as the failure of modern architecture. One effect of this was that:

> "Specific patterns, like, for instance, the light on two sides pattern, vanish from people's knowledge about building … And those few patterns which do remain within our languages becomes (sic.) degenerate and stupid."[3, p235].

Thus he claims:

> "So long as the people of a society are separated from the language which is being used to shape their buildings, the buildings cannot be alive.
>
> If we want a language which is deep and powerful, we can only have it under conditions where thousands of people are using the same language, exploring it, making it deeper all the time. And this can only happen when the languages are shared."[3, p241, 242].

For Alexander, pattern languages were, in part, a way of sharing knowledge about building throughout a society. The concept of local and culturally specific pattern languages can also be found in his work. For example, King [18] discusses the development of a specific pattern language to support the design of a school in Japan, which draws upon the earlier languages, but is specific to the particular community for whom the building is intended. There are parallels to be drawn between Alexander's description of pattern languages and Ehn & Kyng's [13] discussions of design as a language game, and the concept of speech communities discussed by Wynn & Novick [32].

Design patterns in software engineering

Early in the 1990s many software engineers were seeking ways in which design knowledge could be represented and shared between practitioners [6]. This led to an interest in the works of Christopher Alexander and resulted in early workshops at OOPSLA [11, 7] and then to the Pattern Languages of Programming conference series [12]. Discussed at these conferences are patterns and pattern languages that address many topics including the organisation of software projects and teams, design of user interaction, and software architectural design.

Perhaps the best known work associated with this series of workshops and conferences is Gamma et al.'s book 'Design Patterns: Elements of Reusable Object Oriented Software' [15]. Gamma et al. state that a pattern has four essential elements, a pattern name, the description of a problem, a solution and a discussion of the consequences, i.e. costs and benefits, of applying the pattern. Examples of object oriented design patterns include 'Observer' (a generalisation of the familiar 'model-view-controller' architecture for user interface construction), and 'Command' (a software design to implement undoability).

Although Gamma et al.'s patterns do contain cross-references to each other, the patterns do not form a generative language. Rather, the authors refer to their collection as a "catalog". Unlike Alexander's pattern language which has a specific starting point (a root node within a graph of patterns), finding a pattern in Gamma et al.'s catalogue assumes an initial search process. Coplien & Schmidt [12] discuss the differences between pattern languages and pattern catalogues in software engineering.

Patterns and Pattern Languages in HCI

HCI has seen examples both of pattern catalogues [16, 29] and of pattern languages [9, 27]. Whereas software engineering patterns generally describe the structure and execution of software, for example identifying classes and messages between objects, HCI patterns describe properties and behaviours of interactive systems that can be perceived by users. For example, one pattern from Tidwell's "common ground" language [27] is 'Progress Indicator' for which the context, problem and solution are stated as:

"**Context:** A time consuming process is going on, the results of which are of interest to the user.

Problem: How can the artifact show its current state to the user, so that the user can best understand what is going on and act on that knowledge?

Solution: Show the user a status display of some kind, indicating how far along the process is in real time. If the expected end time is known, or some other relevant quantity (such as the size of a file being downloaded), the always show what proportion of the process has been finished so far, so the user can estimate how much time is left. If no quantities are known – just that the process may take a while – then simply show some indicator that it's still going on …"

The pattern is illustrated with a picture of a dialogue window, showing a progress indicator for a file transfer.

A natural question for HCI patterns is how they differ from guidelines or heuristics. There is, in one sense, nothing new in patterns [10]. Patterns are an attempt to record principles that are already known to 'good' designers. However, patterns combine abstract statements of design principles with: descriptions of the context where the pattern can be applied; concrete illustrations of how the pattern might be realized; discussions of the rationale for the solution chosen; and examination of relevant trade-offs that may need to be considered. Hence patterns represent a particular choice for a way of communicating design advice, and may be regarded as more closely related to the 'Claims' work of Carroll & Sutcliffe [25, 26] than they are to work on heuristic evaluation or style-guides.

This issue of patterns as a communication medium has been explored by Erickson [14] and Borchers [9]. Borchers discusses the use of pattern languages to support communication between three domains of expertise in developing multimedia exhibits. He presents a pattern language for the production of blues music, a pattern language for designing interaction with multimedia exhibits, and a language addressing software architecture issues relevant to such exhibits. By encouraging each of these separate disciplinary groups to utilize the pattern languages within design discussions, Borchers promotes patterns as a medium to improve communication across disciplinary boundaries. Erickson [14] takes this position a stage further, speculating on patterns as a possible 'lingua franca' (common language) for all design stakeholders. Erickson explicitly recognizes the importance of including users as participants in this conversation. However, Erickson's work is primarily a speculative discussion of how patterns might contribute to such developments, and he explicitly stated that his ideas had not been applied in practice. Martin et al.'s [19] work presenting findings from ethnographic studies of co-operative work can also be understood as an attempt to exploit the pattern form to aid communication between professional disciplines.

A natural question is whether pattern languages can actually advance active user participation in design. We examine this question in the rest of this paper.

DEVELOPING A PROCESS

In this section, we review Alexander's approach to using patterns languages, and describe the approach we have adopted for participatory design of websites.

Alexander's process model

As we have noted, pattern languages in architecture were originally developed as tools to support participatory design. In a series of case-studies, Alexander *et al.* describe the participatory processes that they sought to develop [1,4,5]. Key elements of these processes were:

1. Removal of the separation of roles between designing a building and realizing it on site, which in Alexander's view, made it impossible to ensure that the building was sensitive to local contingencies. Instead, a new role of 'architect builder' was introduced, responsible for both assisting the users in design and coordinating building activity on site.

2. The architect builder introduced the users to the patterns in order to support localized control of design. The whole user group addressed patterns covering large-scale issues, such as the relative positions of buildings. As the design progressed, sub-groups considered smaller scale details that particularly affected them. The groups or individuals were asked to consider the patterns, criticize and adapt them to their own situations, and to use them to develop their own designs.

3. When developing designs, users were encouraged to use sketches, and to pace and mark out their designs on the ground where building was to take place. This was important to help them visualize the effect their proposals, in the specific context.

4. Within the building process, Alexander sought to use approaches that supported what he called 'gradual stiffening'. This approach sought to avoid the drawbacks of premature commitment in design, by permitting late adaptations to designs.

A process for interaction design

In seeking to apply pattern languages to interaction design we have adapted Alexander's process, combining it with recognized methods from the participatory design traditions in HCI. Our process is as follows.

1. A designer-facilitator works with the user to develop the design. This designer-facilitator role reflects Mumford's view of a facilitator as one who "will assume the role of guide and helper and assist a user design group to move purposefully along the road leading to a successful system" [22, p.263]. Our designer-facilitator was actively involved with the users during paper prototyping asking questions to make the users think and justify their choices. The facilitator is also involved between sessions in developing more detailed prototypes.

2. Phased introduction of patterns, to deal with different scales of the design problem. For example, the user may first be encouraged to consider content issues, followed by general structural and navigation elements, finishing with attention to detailed layout decisions. This sequencing is reflected in the network structure of the pattern languages we have used. In our work to date, we have not considered the issue of designing with multiple user groups.

3. Concrete representations such as storyboards and paper prototyping are used as the primary medium for early design. Users are encouraged to sketch their own ideas, and to make notes about features they would like to include in the design.

4. Iterative development beginning with paper prototypes and sketches, moving through mock-ups of these designs using web authoring tools, towards finished products. This approach mimics Alexander's 'gradual stiffening' and relates well to work in HCI such as Shipman and McCall's [24] notion of 'incremental formalization'.

Using patterns in website design

In order to test whether pattern languages could be used effectively in participatory design of interactive systems, we have developed two pattern languages, each of which deals with a specific class of website.

The first language addresses the design of travel websites. The language was developed by selecting previously published patterns that address the general issue of interactive systems design, and adapting them to reflect the specific functions and needs of a travel website [23]. This language has been used in seven simulated design exercises, in which different users were asked to develop paper prototypes. The users ranged in experience from a retired teacher with no experience of using the web to a trainee web designer. At the start of the session, users were told that following the patterns was not compulsory, and that the illustrations were examples only and not definitive 'best practice'. Design sessions varied between 1 and 2 hours. After each session, users were interviewed to about reactions to the exercise and to the pattern language.

The second language deals with the design of a web-based learning resource. This language addresses pedagogical, as well as interface design issues. The pedagogical patterns examine appropriate active learning activities to include in a learning resource, for example collaborative learning, exploratory learning and learning by doing. The interface and web design patterns address issues of structure, layout, navigation and user actions. This language was used in six simulated design exercises to develop paper prototypes, and in three further extended studies, in which these initial designs were further developed working through iterations of static HTML and then dynamic web designs. All users in this case were lecturers or students, or both, with some experience of web usage but from a range of academic disciplines. An example pattern from the on-line learning language is shown in the appendix.

In both cases, design work using the languages was videotaped to support analysis of the interaction between users, the designer-facilitator and the design artefacts.

Based on a preliminary (informal) analysis of the data from these studies we identified a number of important issues that require further examination. These issues involve questions of both the form of pattern languages, and processes that utilize such languages in participatory design. In the next section we present our observations on the use of pattern languages in design exercises.

ISSUES ARISING FROM THE STUDY

In practical design activities, a pattern language cannot be viewed solely as an abstract information source. We must recognize that pattern languages are instantiated by specific physical artefacts, and the structure of those artefacts may have a significant effect on design activity.

Wording the language

The writers of patterns in software engineering have long recognized the care that must be taken in producing a pattern. In software engineering, patterns are developed through successive processes of drafting and revision within 'writers workshops'. Meszaros and Doble [20] present a 'pattern language for pattern writing', that offers guidance on clarity of expression. Meszaros & Doble suggest that pattern writers should identify a clear target audience [pattern D1], and then tailor the terminology of the language to that audience [pattern D2], avoiding detailed explanations of terms that will be familiar to this well-defined group. A recognized consequence of this decision is that "The pattern or pattern language may not be understandable to those readers outside the target audience if the terminology is too specialized."[20, p. 557].

We began with patterns developed for a target audience of other interaction designers, and then made modifications. However, our users were far more diverse in background than this. There were substantial differences in the time spent reading and studying each pattern. Some users appeared to look at the illustrations only, others spent about 20 seconds on each pattern, reading mainly the bold text and looking at the diagrams, whereas some spent as much as 90 seconds reading each pattern in detail. Writing clearly for such a diverse audience presents a significant challenge. It is clear that the 'designer-facilitator' has an important role in supporting users, helping them to interpret the patterns, and interpreting users' statements. We should also be aware of a possible bias towards users who are more comfortable with large amounts of text.

Most of our users appeared to understand the patterns. The fact that the design domain (web pages) was familiar to most of our users was perhaps helpful in this respect. However, we did encounter some problems. One of the patterns we used included the word 'frames' in the context of laying out a web page. One user (a trainee web designer) challenged the pattern, arguing against the use of frames. Another user (a lecturer in a non-computing subject) did not recognize the term, and the facilitator had to repair this breakdown by explaining frames as an implementation technique to break up a page into sub-areas.

This problem could be more acute where patterns are used to design systems that are less familiar to users. For example, at the current time, many users will not be familiar with designs and styles for mobile or wearable systems. Writing patterns to support user participation in such design will present a greater challenge.

The layout of individual patterns

In presenting individual patterns we followed the typographic style adopted by Alexander [2] and by Borchers [9]. This style presents a motivating illustration first. In Alexander's language, this motivating illustration is a photograph of some physical space or object that instantiates the pattern. In Borchers's language, each pattern is illustrated either by a photograph of a user interacting with a system, or a screen shot of a system that exhibits the pattern. In our travel website language, each pattern was illustrated by a screen-shot of a web page that illustrated the use of the pattern. As with Borchers's language, our illustrations were the very first element of the pattern following immediately after the title.

In practice, we found that some users made extensive reference to the illustrations, often without referring to the accompanying text. The users' heavy reliance on the illustrations has two potential disadvantages.

Firstly, the illustrations may give rise to derivative designs, which simply copy "solutions" from the illustration. For example, the pattern "Step by Step" was illustrated by a screenshot from RyanAir.com, that used a circle to represent each step of booking a ticket, and most of our users adopted a similar approach. One user even equated the pattern with the example picture, indicating that the ones she found useful were those with the illustration, the "pattern", which she had incorporated into her design.

Secondly, we observed users referring to multiple illustrations from different patterns when developing their designs. This suggests that if an illustration contains elements that are peripheral to the pattern in which it resides, then users might interpret these elements as recommended practice, even though the pattern author might not wish to recommend these particular decisions.

These disadvantages may be exacerbated by the fact that our illustrations were placed in a prominent position in the layout of the patterns. Some users suggested alternative layouts. These included: placing the problem and solution first, with the explanatory text appearing later; placing screen shot(s) at the end; and using multiple illustrations.

In the design sessions, users reported that they read the problem and solution text, and looked at the illustrations, but only a few of our users actually read the explanatory text. Even where users had not had the opportunity to read the patterns in advance, they typically spent less than 30 seconds reading the pattern before continuing with the design exercise, suggesting that they were not reading the explanatory text in depth. One user observed: "The style is …quite wordy and could be put more succinctly" (Study2b, User 1). There is clearly a need to reconsider the depth and wording of patterns as well as the layout.

The form of the language

We have experimented with a variety of different physical forms for the pattern language. In the first instance we presented the patterns on single sided A4 paper. Each pattern was presented on one or two sides of paper, stapled together if necessary. In later experiments, we used double sided paper, protective plastic wallets and a ring binder (with dividers) to organize the language.

It appears to be important to be able to handle each pattern individually. This makes it easier for the designer facilitator to introduce patterns into the design discussion, either individually or in small sets. It also enables the user to browse through patterns that they have already seen to find ideas that they feel are useful. During design, users occasionally make reference to information they have previously seen in a pattern, and can indicate this by pointing to an individual pattern, or to a pile of patterns.

During design sessions, we noticed that users progressively handled the patterns more and more, occasionally placing patterns that they had used in a pile away from the designer-facilitator's seat. This may suggest an expression of 'ownership' of patterns, which would be a positive indication user participation.

Our results suggest that the physical affordances of the language are significant for participatory design and that, consequently, efforts to organize pattern languages in hypertext may lose important qualities.

USING PATTERN LANGUAGES

Handling the language

Our results indicate that the behaviour of the facilitator is critical to the effective use of the language. Without exception, users felt that the involvement of the facilitator was vital, the following comment being typical: "at first there was a lot of information and it was important to have you there for guidance and reassurance" (Study 2a, User 1). However, as the sessions progressed, the users were more able to navigate through the language and select patterns themselves. This allows the locus of control over the session gradually to shift from facilitator to user.

The results from our first study suggested that an effective approach is for a small number of patterns (typically between one and four) to be presented together. Users are able to read the problems and solutions quickly before continuing with design. This practice can be used to help the user focus on a small number of relevant usability issues, whilst developing or reviewing some part of the design. We adopted this approach consistently for our second study. We also found it helpful to verify the user's understanding after each set of patterns was introduced, asking questions such as 'what does that pattern suggest to you?'.

In recommending this practice, we should include the proviso that the facilitator must be responsive to user interests. For example, during one session a designer-facilitator is heard to say "*you're jumping ahead, you're good at this*" (Study 1, to User 1) whilst looking for a pattern that was appropriate to the users current focus. In another session, the user indicates that they want their students to examine a series of alternative presentation styles in order. In response, the facilitator suggests looking at a group of patterns that deal with 'step-by-step' instructions (Study 2a, User 6).

The set of patterns can also be used as a "checklist", to ensure that all the issues have been discussed. This can occur in two different ways. Either the list of patterns can be used at the end of a session to check whether all issues have been discussed, and / or the facilitator can use the list to monitor progress, noting when each pattern is used, and constantly reflecting on which pattern to introduce next.

In comparing the designs produced by users, we found that where the patterns were not explicitly managed and presented by the facilitator to the user, certain issues were overlooked. For example, one pattern for travel websites recommends providing feedback about delays that occur when queries are processed. This issue was only considered when the facilitator specifically introduced the pattern. The same result occurred for the idea of including links to other useful sites (e.g. car-hire & hotel booking).

Breakdowns and repair

During the design sessions, breakdowns in communication occurred on many occasions. In such situations, the facilitator is required to identify and repair the breakdown. We observed such breakdowns at three different levels.

At the level of the pattern language artefact, breakdowns may occur where the user misinterprets the intention of a pattern, or of the language. For example, one user reported that when she was told about the hierarchical organization of the patterns, she became concerned that this was a direction to make her website design hierarchical. Another user became confused about the intent of a pattern: "I'm not really sure what it is advising me to do" (Study 2a, User 1). Often the facilitator can avert such breakdowns by discussing ideas from patterns as they arise. Users should feel able to challenge the advice contained in a pattern. Alexander also encouraged this type of dialogue [4].

A second level of breakdown concerns the organization of the design process. Users may be familiar with other design practices such as brainstorming, use of checklists, or spending time studying a large selection of examples before beginning to produce design ideas. Facilitators need to be aware that users may have previous experiences of design processes that will influence their expectations of the design activity. These expectations can be a source of breakdowns in the design process, and our use of patterns to support participation must itself be negotiable.

Finally, breakdowns can occur at the level of the domain. Our first pattern language was intended to support the design of 'travel' websites. Most of the examples used in the language were drawn from rail and air travel sites (e.g. totaljourney.com, theTrainLine.com, RyanAir.com, EasyJet.com and SingaporeAirlines.com). In one design session, the user interprets 'travel' in terms of package holidays. During the design session she uses the phrase 'holiday site', requests options to select 'hotel or self-catering', and wants to see information on 'transfer time' from the airport to her hotel. These concerns are not well represented by the language, and the facilitator did not recognize this divergence of interests.

These events illustrate the important role of the facilitator in monitoring the progress of the design session for possible breakdowns, and repairing breakdowns when they occur. Whilst breakdowns and repairs are a natural part of any participatory design process, it may be that the use of a pattern language (or any other external advisory artefact) introduces new potential sources of confusion.

The authority of external design advice

The pattern language embeds design advice in a form that is separable from the facilitator, contrasting with the more typical situation in participatory design where advice is offered verbally by a single named individual. This externalization can have a variety of consequences. On the one hand, users may feel more able to challenge the advice offered, since they do not perceive such challenges as a direct conflict with an individual facilitator. On the other hand, users may perceive written information as carrying greater weight than an individual's comments. The behaviour and statements of the facilitator in respect of the language may have an important effect on this balance.

In our design sessions, we tried to present the pattern language as an advisory tool that the user was free to make use of but that required interpretation to the user's specific circumstances. However, as design progressed, facilitators made significant statements that indicate alternative levels of authority should be accorded to the language. For example, we have observed facilitators making the following statements when introducing particular patterns in different situations: "… you might want to have a look at some of these things …"; (Study 1, to User 1)"we don't have to bother about 'language of site' … would you just want it in say English…" (Study 1, to User 7); and "these patterns, they're very much based on … grounded on … usability research ... so what they're actually sort of saying in them has been found through research …"[Study 2a, to User 5]. Such statements may significantly alter a user's attitude to the information presented in the language.

Certainly some users expressed their "trust" in the patterns, and indicated that they were happy with their designs because the patterns were "correct" (Study 2a, Users 5, 3). This was an unintentional consequence but one which has important implications. The issue of how to introduce materials and practices at the start of participatory design sessions is recognized in the literature [21], but our results show that facilitators might influence users attitudes to patterns throughout design sessions.

Alexander's work also highlights issues of the authority associated with patterns. The patterns in [2] are each rated with a number of stars reflecting the authors' confidence in the correctness and universality of the pattern. In [4] Alexander reports on a conflict in which the users did not agree with a pattern (entrance transition) that he regarded as fundamental. In this case, Alexander insisted that the pattern was adopted in the design but did so without disadvantaging the users (no family had to sacrifice any of their own choices in order to have this feature). In the end, all users agreed that the feature enhanced their homes. This is an interesting example of the resolution of conflict between user and designer. In this case the authority of the pattern was high and therefore was adopted, even though users could not immediately see the benefit. We need to consider how patterns are validated, and how their 'authority' might be mediated, as well as developing our practice in encouraging users to challenge and interpret the pattern within their own context.

DISCUSSION

In our research, we are investigating ways of using HCI patterns within participatory design, an approach that we view as consistent with Alexander's original writings. Our first investigation dealt with an artificial problem, developing paper prototypes for a travel website. On the basis of that initial investigation, we have developed the approach and applied it, with students and lecturers, to the design of on-line learning resources.

Our results to date, suggest that pattern languages might indeed be useful to support participatory design activities. Overall, users responses were positive, and, once they became familiar with the use of the patterns, they reported that they found the patterns helpful. Of course, we must question the extent to which these positive responses can be attributed to the use of the pattern language, as opposed to the experience of paper prototyping or factors relating to the facilitator.

Related work

The majority of previous work on pattern languages in HCI has focused on the problem of identifying and documenting patterns. See [9, 16, 19, 27, 29]. In our work we have explicitly sought to avoid writing new patterns, preferring to investigate the problems of applying patterns in practice. Other researchers are also beginning to investigate these issues [31]. This practical focus places our work in close relationship to work on 'Tools for Working with Guidelines' [28]. van Welie et al. [30] suggest that patterns could be superior to guidelines as tools to support design practice, but do not provide detailed evidence. Henninger [17] discusses the application of patterns to multiple projects in an organizational learning framework. However he does not examine participatory design, or present analysis of the processes of applying patterns within design. We are not aware of any other work, to date, investigating HCI pattern languages as aids to user participation.

Further work

If we are to realise the full potential of pattern languages to support active user participation in design, our work raises questions of both the pattern language form and facilitation methods that require further work.

With regard to the form of patterns, we are concerned about wording, layout and physical affordances of pattern languages. Our results suggest that users did not find the Alexandrian layout particularly accessible. We are exploring different formats, including "cut down" versions and different orderings of text and illustration.

We also need to refine the facilitation process to enable users to understand the process and the pattern language and to negotiate solutions suited to their own contexts. Alexander viewed pattern languages as fluid and evolving through use. In our studies we saw how this might happen through negotiation and discussion with users. However, our evidence also suggests that some users rely (heavily) on the patterns as authoritative guidance. We need to examine ways of validating patterns, and facilitation practices that emphasise interpretation of patterns in the local context, and the possibility of challenging patterns.

Our ongoing work is to investigate these issues with more users and over longer time frames. We are revising the on-line learning language and will develop and use it with a broader range of educators and students in real design activities. We are also engaged in the development of a medical portal website in collaboration with a group of users. We are evaluating a range of pattern language formats and hope to apply pattern languages in more realistic scenarios involving groups of stakeholders, rather than small numbers of individuals.

Finally, we need to investigate the issue of the quality of the outcomes. Alexander was seeking the "Quality without a Name" [3]. Both the process itself and the products that are developed through it, should contribute to improvements in the quality of life of participants. In our future work we hope to examine whether our pattern languages and processes can help to achieve this aim.

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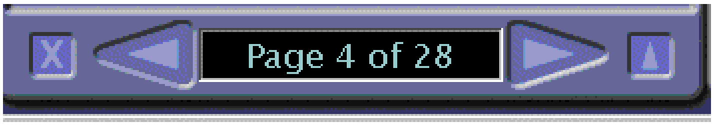
APPENDIX: AN EXAMPLE PATTERN FROM THE ON-LINE LEARNING LANGUAGE

Note: the formatting and typography of this pattern has been adapted from that actually used in our studies for reasons of space and consistency.

CONTROL PANEL (21)

Adapted: Tidwell (1999)

....the user can take actions that affect the existence or state of the whole artifact. Having a control panel it can be used to assist in NAVIGABLE SPACES (16).



How should the artifact present these actions?

The user should know exactly how to stop or leave this artifact at any time.

The user should know what other actions are available.

The user may already know what they have to do, but they need to find the corresponding action.

The user may need to perform these in a hurry, or under stress.

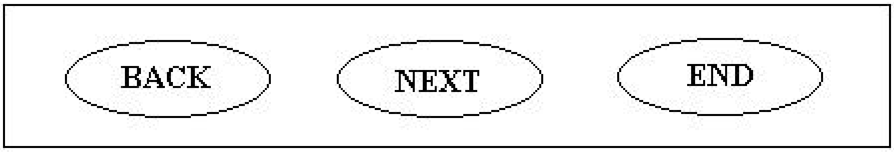
Doing these actions accidentally may be disastrous.

Examples:

- OK / Apply / Cancel buttons on dialogs
- Minimize / Maximize / Quit buttons on Windows application frames

Therefore:

Group these actions together, label them with words or pictures whose meanings are unmistakable, and put them where the user can easily find them regardless of the current state of the artifact. Use their design and location to make them impossible to confuse with anything else.



When using a control panel you may need to consider USING COLOUR (30), VISUAL SYMBOLS (27), and USING GRAPHICS (29). You may want to consider SMALL GROUP OF RELATED THINGS (36). When thinking about the controls to use you may want to consider navigation actions such as: CONTINUE TO NEXT STEP (31), GO BACK ONE STEP (33), and GO BACK TO A SAFE PLACE (32).

Enabling factors for participatory design of socio-technical systems with diagrams

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ABSTRACT
Several authors report failures when using diagrams with a defined notation for participatory design processes. Our experience in various projects was different: diagrams with graphical notations are artefacts which can be used participatively to design socio-technical systems. In this paper we describe our experience from two projects where models of socio-technical systems are designed participatively. The used methods are based on a special view on socio-technical systems. Both theory and case studies provide the basis to derive relevant factors for the process and the notation to enable participation in projects where modelling methods are used.

Keywords
Participatory Design, Socio-technical Systems, Diagrams, Modelling

INTRODUCTION
Diagrams in computer science are used in various fields for developing and presenting models of software systems. They are supposed to support communication for various design purposes (e.g. Harel 1988). Software systems are then created on the basis of such models. Because of this goal, diagrams focus on the technical issues (e.g. Rational 1997) and rarely present the assumptions about the organisational system behind these representations of the technical system. Some modelling methods are proposed and applied, especially in the course of business process re-engineering, to support organisational development (e.g. Scheer 1991). In our view these notations are still to formal and are not able to capture many phenomena found in organisational reality. We have developed a notation called SeeMe which proposes several concepts to represent social and technical phenomena integratedly in a single representation (Herrmann & Loser 1999).

To support the introduction of software systems as well as the organisational change which comes along with this introduction, notations need to be appropriate and appropriately used. Common practice is that a modelling technique is used by specialists, for example external consultants. We intend to use the SeeMe diagramming technique as an instrument to support the participatory design of organisations as socio-technical systems. Ehn and his colleagues (Ehn & Sjögren 1991, Ehn 1988), for example, have already tried to apply methods like these for participatory design. They argued that one day they figured that they are the only ones to whom these descriptions made sense and therefore tried to use different methods. The fundamental - mostly theoretically motivated - critique behind this is supported by several authors e.g. Robinson & Bannon 1991. Ehns goal was to create collective resources to help people to design their own systems by themselves. Therefore they created special representations for the organizational design. In particular, they used domain specific icons so that people can relate the representations to their own practice more easily. The artefacts are supposed to be used as collective resources for design and practice. We share these goals, but in addition we want to create a wider use of the artefacts as mediators between multiple design teams and workgroups. This is neither intended nor possible with domain specific notations.

Our approach to the problem of creating such a collective resource is to use diagrams with a defined notation. However we try to make the notation itself as well as the methods to use the notation more appropriate for participation. We use the artefacts in domains with cooperative business processes where many different viewpoints are brought together. We agree with Ehn that if only designers are involved in the creation of diagrams these are the artefacts of these designers and therefore are hardly comprehensible to others. So we try to get more people involved into the creation of the diagrams. Therefore, we have created processes where people become qualified to use the methods and to apply them for themselves, meaning that they can reflect on their own socio-technical system and make plans for the future development of their system. In consequence, the success of a project which uses diagrams should be visible by the following aspects:

- Reference to diagrams
- Participation in discussing what is, what should be and how it should be represented
- Making proposals for changes
- Changing diagrams without help

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ISBN 0-9667818-2-1.

- Mutual learning
- Convergence of understanding
- Confidence and clarity for practice
- Confidence for changing the practice
- Plans for future use of the artefact

We applied a notation which is more appropriate for the use in socio-technical settings because it supports an integrated depiction of technical and social phenomena. A diagramming and presentation tool which supports both the collaborative processes and the creation of diagrams accompanies both methodical parts.

Many of the concepts of the method and the notation can neither be derived from case studies nor can there be any general proof of appropriateness from case studies. Only usefulness in the boundary of the individual cases can be shown. It is helpful to develop a theoretical background which grounds in the current experience and elaborate theories from relevant fields. As the notation should represent and should be used in socio-technical settings with information technology we considered certain relevant literature and theories from social sciences and general systems theory.

In this article we will derive relevant factors to enable participation in projects using such a method based on empirical studies and on theoretical insights. We start with descriptions of two case studies, where socio-technical systems are designed participatorily and continue by giving some theoretical considerations on socio-technical systems and modelling notations. In the first case study that we have already reported in PDC 2000 (Herrmann et al. 2000) we applied the diagramming notation for the first time in a complex environment and developed methods to qualify people to use such a modelling method. The focus there was the development of methods to qualify participants to develop groupware applications. During this case study hypotheses were developed about how people can make use of the method. The hypotheses we had in 2000 are more methodically explored in a study where the design for future practice was facilitated using the method. The theoretical discussions also point at a wider range of relevant factors to make such a participatory project successful. Finally, we summarize the relevant issues.

BASIC ELEMENTS OF SEEME

Before we describe the case studies we have to give a very brief overview of the notation SeeMe – socio-technical semi-structured modelling method – to make the examples comprehensible. A detailed description can be found in Herrmann & Loser 1999.

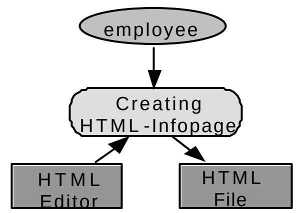

Figure 1: Simple example of a SeeMe-Diagram

Basic Elements: SeeMe is based on the basic concepts of role (ellipse), activity (rectangle with rounded corners), entity (rectangle) and relation (directed arcs). Roles describe a set of rights and responsibilities assigned to a person, a group or an organisational unit. Those parts of a system which can be the addressees of expectations of others (sanctions, assigning of rights etc.) are represented as roles. When persons playing a role are in action, they are performing activities. Activities use entities as resources (documents, tools, computing systems etc.) or they manipulate entities. Fig. 1 gives a simple example with the following basic elements: the role *employee*, the activity *Creating HTML-Info page* and two entities *HTML Editor* and *HTML File*. All elements in a model are at least specified by a name. More precise descriptions are possible by adding attributes or by giving detailed specifications by means of sub-elements, which are used extensively in the practical examples in this paper.

Relations: Relations connecting basic elements are depicted as directed arcs. Relations visualize possible logical connections as a result of a relation between two elements. All mutual combinations of basic elements are possible and have a predefined meaning. The most important examples of these meanings of relations are used in the example in Fig. 1: the role *employee* is *performing* the activity *creating HTML-Info page*. This task *Creating HTML Info page uses* an *HTML Editor* to *create/manipulate* an *HTML File*. Relations can also be qualified for other meanings.

Several concepts are added to this foundation

- to make vagueness (incompleteness and uncertainty) explicit.
- to present different kinds of attributes.
- to alter different perspectives or points of view using the same notational system.
- to integrate meta-aspects and self-reference.
- to represent social interests of roles or role playing.
- to represent but not restrict free and arbitrary decisions (contingency).

RESULTS OF A PREVIOUS STUDY

In an earlier project – a modelling project within a printing company, describing the PDF-Workflow – a process was under investigation where learning the application and applying a modelling technique took place at the same time. There was a basic training in modelling before the modelling project started (see Herrmann et al. 2000). Learning was continued while applying the knowledge to create the diagrams for a complex cooperative task.

This study was the first participatory application of the modelling method. For smaller projects or minor tasks we already had some experience with how people work with the notation, but it had not been tried with a topic of this complexity. It was not a design project in the sense of developing something new, but a collaborative reflection on current practice.

As media for the modelling process, paper-based sketches on pin boards as well as large plots were used. This setting which was based on earlier experiences (s. Walter & Herrmann 1998) demonstrated several advantages. For the depiction of new content, the relevant elements of the graphical context were noted first on the empty wall-charts to allow the participants to orientate and set new parts in context with the already depicted areas. The experience was that ideas are quickly sketched on the wall-charts. Already modelled elements representing tasks at coarse level were used to prepare empty frames with surrounding elements for the topics of a session. Elements were depicted in this context and from there the missing detail was filled in. The existing status of the diagrams was also printed on large plots and hung around the room to be present. This made it possible for participants to refer and to make ad-hoc corrections to them. The plots have a physical presence in the room filling the walls and participants can easily focus an area under discussion. Changes to diagrams are visible as they are drawn on the plots and at the end the result of the session is visible. The problem is the correction of sketches. It is partially helpful to use cards to draw the elements, which can easily be replaced, but structural changes are still hard to visualize during the group meetings.

Although not all participants in the modelling sessions had also participated in the initial SeeMe-Training, all participants seemed to have picked up a basic understanding of the modelling technique. We think an introduction to the modelling technique is helpful, but it seemed to be possible to start a participatory design process using modelling methods almost without previous knowledge of these techniques. The learning of the techniques is done along the way, explaining the concepts with examples coming from the task at hand. This was a helpful hint, because in the participation process it is a motivational problem to introduce a modelling method without having a task that is relevant to one's own practice.

In the second case, we tried to give a very brief introduction to the modelling method only and attempted to take care to facilitate learning during the modelling sessions.

The group was able to create a very complex representation of their work practice (of course with the support of experienced modellers). Participants were not computer professionals who are used to the handling of abstract diagrams, but employees, experts in their domain, with no experience in using modelling techniques like SeeMe. With the guidance of experienced modellers they were able to express parts of their practical knowledge, referring to models and using the models and the modelling language. Help was needed to introduce new concepts, repeat explanations and give hints on similar parts of the model. It was observed that the participants referred to the diagrams in the discussions and used them.

NEW PROCESSES FOR A NEW SOFTWARE IN A UNIVERSITY LIBRARY

Background

At the end of 2000 we started a modelling project with two workgroups at a university library. It was planned to use a new software-system for their work on the acquisition and cataloguing of books. There is a fundamental difference between the organisational practice at that time and the type of processes required by the new technology. For this project we were asked to help the groups to redesign their new work processes using a new software system.

The traditional practice in the library was to start with the acquisition and to do the cataloguing afterwards in a sequential process. Both fields of work are carried out by specialised workgroups. Now, with the availability of software system based catalogues, the simplification of the cataloguing reduces the required qualification in most cases. What was formerly the supreme task in the library has become simple for many of the new books. There are catalogues available that already include most of the books to be acquired in the library. With the new system, cataloguing can be done in the early steps of the whole process and a high quality of data is guaranteed.

A main reason to introduce this new system is the seamless integration with the software-platforms of the other departments. However, the software system provides more functions than needed and is not sufficiently adaptable to the situation in the library. Results of the modelling project showed, that an "integrated process" will work, but that the software system creates complexity without creating enough value. Finally, the introduction of the system was cancelled, but the integrated process is now practiced as planned, using the already existing software system. For this purpose the workgroup changed the diagrams themselves. In December 2001, there was a kick-off meeting where the other members of the library were informed about the new work-process and where the new process was launched.

For the scientific analysis of the project a member of the research team created structured protocols of the modelling sessions. The last 4 sessions were also video taped. After the project we conducted semi-structured interviews and experiments with the participants to create a clearer view of what they understood and how they personally used the diagrams.

The process of facilitating socio-technical design

The project with the library developed a diagrammatic representation to plan and discuss what will be practised, when the system is introduced. Fig. 2 shows the overview of the diagram, including the main tasks performed during the process. At the end of the process the group should have a "shared" understanding of what the future practice will be. Therefore eleven workshops were conducted. The two leaders of the workgroups for acquisition and cataloguing who also remain practitioners, two librarians, one library employee, responsible for exploring, testing and adapting the new software, and a domain expert, also managing this project, participated in this project.

The first workshop introduced the modelling method briefly and discussed the goals for the project. The goals for the group were to design the work process, to create a documentation for reference and to exchange experiences within the workgroups including knowledge about the used software system.

In the beginning of the modelling process overviews were created showing the participating roles and the main activities of the process. Further tasks and subtasks of the main activities were informally collected to create an idea of the areas to be described. In the preliminary diagrams vagueness elements (semicircles with three dots) indicated the incompleteness of the diagrams. Participants agreed to use this diagram to organise the modelling process. During the process the participants were discussing and imagining the future practice step by step with the artefact under development. So during the following sessions the main process was filled with more detail. For the first steps this was simple, as the new system was not supposed to be used extensively in this part of the process and much of the work was left unchanged.

For the following tasks it was not that easy: the options for different process designs were unclear and it was not possible to see what was supported by the software system and what was not. Because two participants had looked into the practice of another library, which was already using the system, the group decided to depict what they understood about the process in the other library, and then to compare this with the requirements of their library. The group was aware that the process could not just be "copied" in their own library, but that parts of the process could be reused and become part of their process. During two sessions the diagrams of the process in the other library were created. By discussing and depicting what was actual practice in the other library their own ideas became more elaborate and finally were depicted easily in a single session, reusing and referring to various parts of the diagrams that existed for the other library.

The final phase of the design process was to integrate the various special cases such as to handle norms, electronic dissertation theses, messages regarding orders, expiration of the delivery period, crediting/subsequent demand, bills, books for approval, gifts, donations or barter deals (all hidden in fig 2, visible as a residue – the black semi-circle – on *Acquisition and cataloguing*). During the final session the diagrams were checked and adapted for consistency and correctness.

After the project it was decided that the new software system would not be introduced. The discussions in the modelling project contributed some of the arguments which led to this decision because it became obvious that the system did not cater to the library's needs, neither was it adaptable to them. However, the newly planned work practice in general was introduced. Without our help the workgroup changed the diagrams to show the use of another software system. For now, the software support remains the system that had already been in use, and the next version of the formerly planned software product will

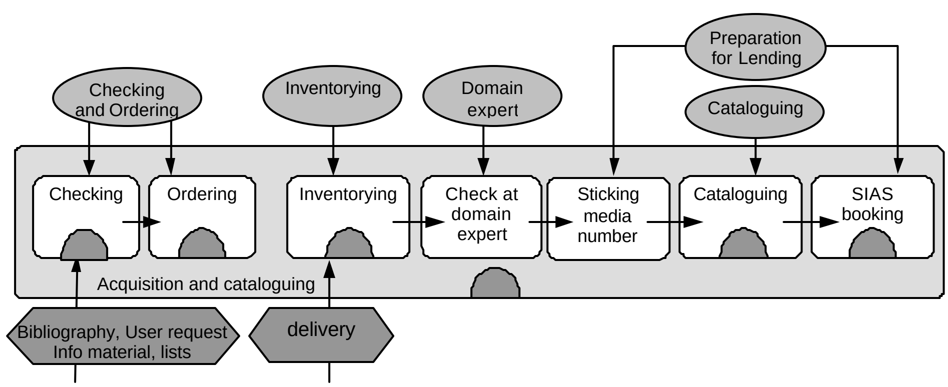

Figure 2: Overview of the acquisition and inventorying process

be evaluated. At the Kick-Off-Meeting of the new process the workgroup used the diagrams to give an overview and to explain other members of the library how the tasks will be done in the future.

Major design issues

While developing the diagrams three areas of design were remarkable:

1. Personnel
2. Exchanging practical experience
3. Workarounds and adoption of the technical system

Personnel (1): The system's and the top management's philosophy is aiming at a "fully integrated" workplace where one employee is responsible for the whole process starting with a user's demand for a book to its integration into the library's catalogue. This guideline creates complete tasks, but it can only be partially realized with the existing personnel, because everyone should have an appropriate job. Some discussions dealt with finding and creating these jobs. Because all tasks in the process are shown in the diagrams, necessary qualifications and abilities can be evaluated. This discussion was visible in the diagrams, where the representation of a role was required although it was neither appropriate to assign a name to it nor any attributes. This role was related to a special activity which could also be carried out by other roles. However, the role had to be represented because it was necessary to give someone a job who was not able to work on more complex tasks. Since there was no sensible approach to how this role could be integrated into an official chart of the organisation, everyone agreed first on a vague solution: There is an unspecified role which puts the inventory number into the books and the question mark indicates that the correctness of the unspecified role is doubtful and therefore a rethinking will have to happen at a certain point in time. After this rethinking at the end a more complete role was set together with other more simple tasks, called *preparation for lending* (s. figure 4) that also includes the task of *SIAS booking*. Marking the role with a question mark was highlighting the role, making the speciality very obvious in the diagrams. This was to obvious for the participants, so they decided to hide this role and agreed on setting together the new role *preparation for lending*. Their argument was that both tasks are somehow related and are usually done by the person who they had had in mind.

Exchanging practical experience (2): The tasks of the employees are from the two areas of acquisition and cataloguing. Since the tasks for both are integrated at single workplaces, the exchange of experience was initiated during the modelling sessions. In both areas, things were unclear and became clearer for some participants with the discussions. Questions like: *"Are you really sending a notification to every domain expert?"* or *"How often does this case occur?"* are examples from discussions bridging the experience gap between the two work groups. As personal understanding became visible on the walls, participants questioned their own or the visualized understanding and there was the opportunity for personal or group learning. This led to a converging understanding within the group. This was seen as one of the major outcomes of the modelling project: *"Maybe,…no, not maybe, I'm quite sure, that both groups didn't know enough about each other because they had little contact. It was eye opening just how diverse the tasks are in the others domain. Before, only the necessary arrangements were known."*

The interviews revealed that the result of mutual learning was one of the major positive outcomes of the project for the participants.

Workarounds and adoption of the technical system (3): As mentioned, the system did not support the specialities of this library in many situations. To overcome these deficits of the software system, the group searched for several workarounds. A simple example which is observable regularly with this kind of system is that unneeded fields in the database are used for other purposes than intended by the developers. Some of these solutions became obsolete, because the system was not to be introduced as planned earlier. The workarounds and special solutions for the system become very obvious by a comparison of the state of the diagrams at the end of the modelling project (when it was still intended to use the software) and those diagrams where these solutions are deleted from the diagrams to depict the now introduced process.

Evaluation of the project

The development of the organisation and the adoption of the software system were closely related in this case. All of these discussions were facilitated using the diagrams as the main artefact to be created. In this sense the diagrams were used to negotiate, plan and communicate the future practice in the organisation.

In comparison to the first project the result was a design in advance rather than a reverse design and a reflection on current practice. The diagrams represent the planned practice for the groups and not the already existing practice. To imagine the future practice and discuss issues about it, presents a major challenge to such a project. There cannot be any evidence that what was planned will be in any sense a "correct" representation of what would be real practice. On the other hand all participants found it helpful, to plan and create some picture about what will happen. Basically the process led to higher practical confidence among the participants. The creation of the diagrams supported this by structuring the process and making the progress visible: *„Well, I think it was an unbeatable advantage, that we had to clarify what really happens. Well, each time we became fuzzy, and meant this might be like this or like that, we weren't able to represent it or didn't want to represent it. We had to say: well let's think about what really happens at* *this specific point. I think this made it hard work and lengthened the process, but at least we have an accurate overview now."*

Discussing the role of the diagrams, it was clear that some discussions are not reflected in and with diagrams but for others, diagrams are a main focus for clarification. One example of invisible discussions is the comments on historically developed practice in the library, like the identity of the inventory number and the reference number. These are rationale that have effects on the diagrams, but they are not directly visible. An example for a discussion which was based on diagrams was discussing the way the other library was working. This comparison became structured by the state of the diagrams following the open issues which have to be depicted next. Contrasting themselves with the practice of others, it became easy to develop a model of their own practice.

It had already been discussed that the project also was initiated to provide a place for exchanging experience between the two groups. The interviews showed that the participants see this as one of the major outcomes. Creating the diagrams structured this exchange and showed the necessity for clarity about how things should be done.

During the project every participant gathered knowledge of the modelling method itself. As a result it was possible for the group to make changes to the diagrams without any help from others. They adapted the diagrams for the currently used software system on their own. Part of the interviews was a brief test of modelling knowledge, consisting of reading and discussing ability and of basic understanding of the notational elements: the average of the participants was 16 points (with a minimum of 12 and a maximum of 21). Two persons with modelling experience with the method reached a level of about 30 and two persons without any modelling experience reached approx. 8 points. In this project there was only a short structured introduction to the method at the beginning.

After using the notation in such a long project it might seem that the participants should have more knowledge about the notation. Looking at the details it is obvious that regularly used concepts are understood by most of the participants whereas concepts used less often or even only discussed and introduced are more problematic. At some point it might have been helpful to reserve a session to do some more structured qualification, to provide more details of the meanings of notational elements. The participants found a little summary page of the notation extremely helpful, it was present as poster in the early sessions, but they would have appreciated the page for the use after and before the modelling sessions.

DIAGRAMS AS REPRESENTATIONS FOR SELF-REFERENTIAL SOCIO-TECHNICAL SYSTEMS

Certain aspects of a method can be evaluated, the appropriateness of a method as a whole cannot be proved with this kind of study. In this chapter some aspects of our method are motivated from certain accepted theories.

In both cases diagrams are used as representations of one's own socio-technical system. Usually, the term "socio-technical system" is used to emphasize that aspects of both technical as well as social sub-systems should be considered and that there is a very complex relationship between both. It is common to use this term in this simplified sense although there is a long history of the term socio-technical system. The roots are in the 1950s where the term had already been emphasized in the context of the coal mine studies of the Tavistock Institute. Later it was adopted and developed further by the Norwegian industrial democracy project. The term in this tradition is closely bound to a set of principles and values that point at a participatory approach to the introduction of technology. We agree with most arguments that lead to the development of different approaches or adaptations of this concept. But we also think that taking the original term by name and exploring the meaning in the light of new developments in systems theory and relevant social sciences can lead to helpful insights.

Included in the term socio-technical there is the distinction between social systems and technical systems. To get an idea of the difference we should think about who or what assigns something as belonging to the system or not. While living systems as well as cognitive or social systems are autonomous, technical systems are controlled from outside. Autonomy means that the behaviour of the system depends exclusively on its own structure. The behaviour is orientated towards a continuous maintaining of the system's identity and re-making of the system by itself – it is autopoietic (Maturana & Varela 1987). This process of continuous self-remaking has to be guided by a kind of description of the system which has to be integrated into it as a part of itself. This phenomenon is called self-reference (Luhmann 1993): it is the system itself which implicitly – by remaking itself – "answers" the question of which elements and relationships belong to it, or not. In the same way, the system is autonomous with respect to the question of how it reacts to influences from outside and how the perceived behaviour of its environment is transformed into information processing or into operations. By contrast, in the case of technical systems whether an element is part of the system or not is determined from outside. Technical systems serve purposes which do not lie within themselves, but are assigned from outside.

Creating a combined system with these two types we create a new phenomenon which is called a socio-technical system. Each technical system has a special relationship to the social system which produces and maintains itself but we do not consider this relationship to be the basis of a socio-technical system. The special problem is that from the very moment when a technical system becomes an integral part of a socio-technical system, a new integrated phenomenon is developed. The high degree of integration, which makes the system a single unit, can be seen in reciprocal inscriptions (in the sense of Latour): The communication of the social sub-system reflects the characteristics of the technical system and the technical control structures mirror the properties of the social interaction.

One special feature of a socio-technical system is the way it constitutes itself. This happens with special development and adoption processes where a system incorporates new technical elements. This adoption process is a social process (e.g. Orlikowski 1996) which cannot be fully planned in advance. In our view a socio-technical system is an integrated unit. To design and develop it as such a unit, we try to support the process with external descriptions. We use graphical representations based on a given notation. Several others were proposed for this purpose, too (e.g. Ehn & Sjøgren 1991). Luhmann stated that social systems are self-referential and therefore include descriptions. This is also true for socio-technical systems; they already incorporate several types of descriptions. The description of the social-system is encoded in conventions, in the verbal elements of a shared semantic system, a meaning system or even in written rules or laws. In organizational systems coordination is a major issue that is dealt with by these descriptions. Of course technical systems are described by engineering artefacts computer systems in particular are described by software-engineering oriented modelling methods or program code. Today both types of descriptions are separated, often not made explicit and hardly reflect each other. With the modelling method SeeMe we try to bring both kinds of descriptions together and make them explicit.

In both case studies the evolution of a socio-technical system was supported with diagrams. Certain requirements for a notation arise from this. Ehn (1988) suggests a domain oriented organizational toolkit to create diagrams of the organisation which is designed for the specific domain. He states that the resulting diagrams are only used by the participants of the design project. However it is not likely that all affected people are involved during design projects. Usually the diagrams are relevant to many more people than the participants, who, where possible, should act consistently with the depicted ideas. Another point is that the group itself is not a closed social system, and has several relations to other parts of the organizational system and to the environment of the organization. The description has to support these relations and a notation is needed, which can be used in different domains.

Star's notion of boundary objects is highly relevant to this: "Boundary objects are objects that are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use." (Star 1989) A notation can try to support both requirements for boundary objects: Providing a common notation in a socio-technical system which can be used across workgroups and domains makes these descriptions robust. To create flexible descriptions, we introduced concepts to make vagueness and uncertainty explicit, leaving space for contingent action. SeeMe basically supports two concepts to describe systems vaguely:

- Intended omission of information known by a modeler (or group of modelers), but is not willing to present in a diagram.
- Expressing recognized vagueness or doubting completeness/appropriateness of contained information in a diagram.

Expressing vagueness can be used in combination with all elements: models, elements, relations, modifiers, attributes. The two basic concepts aggregate various sub-cases. One example is shown in figure 2 where the grey semi-circles show that there is detail, which has intentionally been left out in this diagram (intended omission). Grey areas (residue) can be clicked on to navigate to details that have already been modelled.

Relations can be connected to the totality of an element (specified) or to its possible parts, such as sub-elements (unspecified). Relations, at both ends, are not necessarily connected with one specific (sub-)element. The unspecified connection of a relation is especially helpful to model processes vaguely. Usually the semantics of process models is that one step is completed, then the next begins, like in state charts or petri nets. In socio-technical processes where activities can also be ongoing processes, the start of a following activity can happen at any time (vague information) while the predecessor is still active. This concept is also helpful to reduce complexity, for example, if the complete expression of all connections between two elements with many sub-elements is too complex to be shown in one diagram, the connections can be simplified to one unspecified relation or to meaningful subsets of the whole set of relations.

One example for the usage of vagueness from the library case can be found in fig. 4. There are several steps and checks considered necessary by the participants before a book should be ordered: Is it *already ordered*, is it *already existing* in the library or is there a *previous edition* a user can be referred to? After these checks certain steps follow, which are not shown in this extract. Regarding vagueness a remarkable part of the diagram shows that in some cases documents will be sent back to a domain expert. First, with the relation beginning inside the activity of *checking*, it is represented that it is not defined at which time this task starts during the performance of checking. Secondly there is a condition showing three dots, representing that there is missing information to specify it definitely. The participants here could not or did not want to specify this condition. So this diagram is just saying: for some reason the role checking and ordering decides to send back documents to domain experts. Thus the decision is left to the people performing the tasks in a specific situation. If there was the need to specify this condition here, the participants might have chosen to neglect the task. Which might be a problem for future use like qualifying newcomers with the diagrams. The other option would be to specify the condition, which may lead to a inappropriate condition.

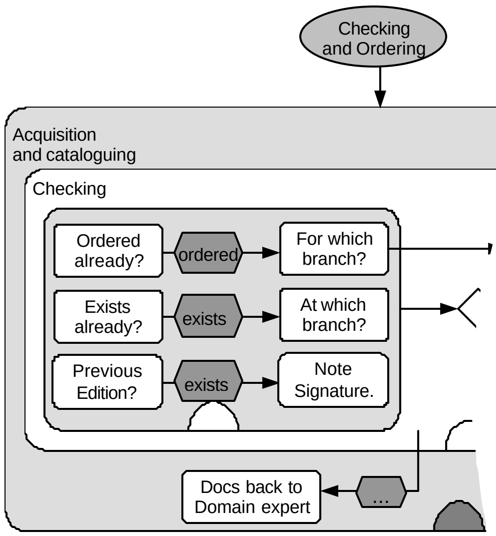

Figure 4: Example with vague Elements

Complex organizational systems create complex representations. Understanding is a major issue with complex diagrams. They are hard to follow and not everything is relevant to every recipient or participant at any time. There is a need for support for reduction of complexity. We use nesting to support this. Various types of relations between sub- and super-elements which build hierarchies are often presented using nesting of structures (e.g. Harel 1987). An example has already been mentioned: in fig. 2 the activity *Acquisition and cataloguing* is specified with its sub-activities. Embedding is used in an informal notion, simply understood as unspecified hierarchical relation. Nesting then builds a foundation for the dynamic presentation of models. Our modelling tool supports the hiding and showing of details which are embedded in elements. Additionally, not only sub-elements but also super-elements can be hidden, so that only elements on certain levels are visible. With this feature users can flexibly select the degree of visibility of the context of a certain element. The goal is to make it possible to present and develop large models that cannot be understood at once. The software tool supports the exploration of models as well as the preparation for their presentation. We used this in various ways in the above cases. Before we had the modelling tool we used Microsoft Powerpoint to create the diagrams, only simulating the dynamics of hiding and showing with hyperlinks to defined diagrams and animations. The modelling tool now supports the hiding and showing of elements so that detailed experiments with this concept can be carried out for an evaluation.

FACTORS TO ENABLE PARTICIPATION

As a result from the two cases and the theoretical discussions we derive several factors which we found to have a positive effect on participation. They can be divided into two groups for the methodical parts: Modelling process and modelling notation.

Process factors

Regarding the process we see the following points as relevant mostly resulting from experiences made in the case studies. The first group of issues deals with the qualification and motivation of participants:

- For motivational reasons the qualification for the modelling notation should be intertwined with the task of a project group. This can be done in various ways: in a day workshop a higher level of knowledge can be reached initially like in the PDF-Example (Herrmann et al. 2000). A two to three hour introduction creates less knowledge like in the library, because there is not enough time for instant application during the session. In both approaches concepts need to be discussed in detail at the time of usage.
- It is known that such projects need a lot of personal effort and motivated participants: therefore the group should have a clear task and the power to fulfill this task autonomously. In the library project a very unclear situation was solved: the participants did not know how to deal with the task of developing an "integrated process". The problem was structured with the models so that a high motivation could be maintained during the project.

Another group of factors is concerned with the setting and technical use of the diagrams:

- So far we have had positive experience with paperbased settings. Wall charts made reference easy and simple changes could be done quickly. Sketching first drafts is easy. More complex structural changes to diagrams are not as easy, so we also want to try digital environments for this kind of project. Maybe a setting with multiple large scale displays is usable.
- In the group sessions, results of previous sessions should be visible to represent the current state of the project and to make reuse and correction possible. The rules of the notation should be present (Poster and a handout) This serves the purpose of laying out a setting

which is appropriate for the artefact and the participative process.

- The most important issue is that only minor changes are made in the absence of the participants who should develop the diagrams. Usually you would transfer diagrams between media, and adapt the visual layout for aesthetic reasons. Every simple change made in the absence of the participants needs to be presented to the participants in the following session.

One should think about which expertise should be involved in such a project. The next group of factors are related to this question:

- The facilitator needs to be an expert in moderating this kind of process. As the goal is to create a single representation, conflicts might arise. With the notation of vagueness, no single solution needs to be fixed: alternatives can be depicted as well as contingent action based on the situation. To do this, the facilitator needs to be an expert in the diagramming technique too.
- All relevant practical experience from current practice should be involved in the project.

For the modelling process itself certain steps are helpful. We have good experience with the following:

- For design projects a process should be set up as a socio-technical walkthrough. The mental process is to develop a representation, which shows how the future can be. With this process the future becomes clearer in the participants minds and the expertise of all participants is activated.
- At the beginning of a walkthrough it is helpful to create an overview. This creates an agenda which is then used to structure the process. The overview also makes the progress of a project visible.
- The modeling process should start with the representation of activities, because they can be oriented to the tasks of participants. Roles and entities are then easily completed.
- In certain situations it is helpful to search for comparable systems. Examples are processes where similar software systems are used, or discussing the software system to be introduced with other (external) users of the same system like in the library case.
- During the design the difference between what makes sense from an organizational viewpoint, and what is only required by the technical design of a software system should become clear.

Factors for the notation

Regarding the modeling notation we see the following points as relevant, most of them motivated by theoretical considerations:

- For qualification of participants it was helpful that SeeMe can be devided into subsets which can be viewed as beginners, intermediate and experts, so that you can start with simple elements and discuss more complex in the course of a project.
- To be used as boundary objects between groups in organisations, a defined notational systems is helpful. At the same time artefacts need to be flexible in use and representation. We support the flexibility of representations with concepts to show vagueness.
- To bridge boundaries and to focus group sessions representations should be reduced to relevant content. Different levels of abstraction as well as hiding and showing of certain detail should be supported.
- The results should be navigable so that participants as well as external people can view the diagrams flexibly without becoming immediately overwhelmed by the whole complexity. For similar reasons diagrams should also be presentable. This also gives some reason for supporting the creation of diagrams with a certain level of ergonomics and aesthetics.
- In the projects it was helpful that it was possible to use the notational system with different media. The first draft should easily be sketched on wallcharts, presentations should be possible (slides as well as with presentation software) and a software-based editor should be possible.

CONCLUSION

In this paper we presented two case studies where socio-technical systems were designed participatorily using diagrammatic representations. A theory of socio-technical systems re-making themselves supported by models as self-referential descriptions was outlined. Along the way we gave examples of our diagramming notation SeeMe, which makes the representation of socio-technical phenomena possible. From our experience and theoretical discussion we derived several factors which should be considered when designing a successful process.

In the two case studies people without any modelling background contributed to the design of their own practice and created a diagram that represents this practice. In the first case the application of the modelling technique helped people to get a clearer picture of their own cooperative practice and to prepare material to qualify new workers. In the second case, future practice was envisioned. Applying the modelling technique helped people to plan the necessary organisational changes in advance and to realise the problems of applying the new software system.

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PD in the Wild;
Evolving Practices of Design in Use

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ABSTRACT
The when and where of participatory design has traditionally been set, primarily, by the software design project. However, modern IT networks with a variety of applications from different software providers, new web-design tools, and the integration of customization processes with on-going version management, are just a few of the developments that are moving participation around IT design issues beyond the traditional software project. Using examples from a research project focusing on existing work practices and IT in use in public service administration, we explore various understandings of design, which challenge some of the assumptions underlying the basic framework of participatory design.

If design is seen as continually on-going, and intricately interwoven with use, this raises several important issues for participatory design. It highlights design for change. It points towards the need for reconsidering software design processes. It brings into focus issues of coordination between use, design in use and adaptation and development. Crucially, it raises issues about shop floor IT management, that is, organizational and technical support for local adapting, and continual design and development in use, of IT, and the need for models and methods for sustainable, distributed co-constructive design processes.

Keywords
Design in use, evolutionary design, shop floor IT management, public services, one-stop shops

INTRODUCTION
'*What, precisely, do you mean by design?*' the moderator asked us. Five of us, two researchers and three Ph. D. students, had just finished constructing a collage on the whiteboard. We were cooperating around the *Design of IT in Use* project, which focuses on supportive technologies for public service provision. Each co-presenter had added more steps and more detail to the multi-colored complexity of circles, arrows, figures and keywords we were using to illustrate our presentation.

The design we were talking about had gradually shifted character as we worked our way across the whiteboard, from left to right, from systems developers and consultants to local technicians, to web designers, service providers and 'citizens/users'. On the left-hand side of the board, design seemed to be about the solution-planning phases of software engineering. Design, here, was the work necessary to get done before, and during, the actual coding process. On the right-hand side of the board, a social constructionist perspective prevailed. Here, *use* of technology was *design* of technology. The moderator's question brought our varying perspectives and starting-points into sharp focus. *Who is designing what for whom?*

Different groups of people were definitely cooperating in design processes in this panoramic view of IT in public service provision. In fact, the software developers seemed to be playing a rather minor role in the over-all picture. A participatory designer, or a software developer practicing participatory design – the normal addressee of participatory design methods – would miss a large part of the cooperation around appropriation and tailoring in this picture, as it was taking place beyond the temporal and organizational scope of any project.[1]

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[1] See [20] as an example concerning the presumption of the participatory designer as the addressee of participatory design methods, and the project as the scope in which participatory design takes place.

In this article we explore this 'participatory design in the wild' further, and discuss its implications for the conceptual framework of participatory design as well as for its methods and tools. Suchman challenged the borders between technology production and use as culturally established and often ideological rather than empirical. [30] With our observations, we would like to contribute to a better understanding of evolving 'working relations of technology production and use', and of the implications for the conceptual frame of participatory design as well as its methods and tools. We indicate in which directions participatory design might be developed to accommodate and support practices of design in use such as we have observed in our field studies.

Design as a continuing process that goes on after the formal end of the software development project is, of course, 'old news' [24, 26]. Tailoring and the role of end-users in customizable software has been taken up in a diversity of scientific discourses. The 'new news' is, that this is where much of the action is today, and it is a much more complex and diverse scene than it was ten years ago. In this article, we argue that the framework and rhetoric of participatory design, at least from a Scandinavian perspective, need to be expanded to include and highlight on-going design in use and evolving practices of 'PD in the wild'.

DESIGN IN USE

In a joint, interdisciplinary research project, we started to use the term 'design in use' [7, 18] to capture practices of interpretation, appropriation, assembly, tailoring and further development of computer support in what is normally regarded as deployment or use. In the following, we present examples of these practices as a base for discussing the implications of such changes in the use of technology for the understanding of design and use, and for the understanding of participatory design in such contexts. Not only the initial embedding of an application into a specific context, but also the practices that develop around tailoring, can be considered as 'design in use'. Understood in this way, 'design in use' becomes a powerful concept, which highlights the incompleteness of any technical artifact, even the most skillfully designed one, and the need for its continual adaptation and further development. 'Design in use' emphasizes the creativity that lies in the embedding and use over time of the technical artifact. It therefore both motivates the conscious implementation of participatory design, and highlights what often passes un-noticed in design discussions: *the actual on-going cooperation in design practices in everyday use of technical artifacts*. [2]

In the following section, we present different practices we have observed in our case studies. These examples provide the base for our claim that, in many cases, design and use should not be regarded as two separate and sequential activities, but rather as on-going in parallel, intertwined, overlapping, with shifting foci and agencies. The question this raises is: how might these different, co-existing practices of design be more deliberately and consciously put in dynamic relation to each other?

The relationship between design and use, their overlap and intertwine, is a core issue of participatory design. Use has to come to design, and design has to come to the users, in order for developers and users to cooperate around the design of software or other technology.

Since the involvement of users in design, development and introduction of technology was a novelty, the developing participatory design community and related research discourses addressed a variety of issues: from organizational politics, via methods to mediate the cooperation across professional borders, to an adequate organization of the development process to provide space and time for such cooperation. [5,21] The majority of these methods aim at bringing use to design.

Parallel with the development of methods to bring use to design, the understanding developed of what happens after the introduction of a new computer application. Reports from detailed studies of computer supported cooperative work challenged the naive understanding of use as the implementation of its anticipation in design. Rather, these studies showed how software is embedded into a developing use context in a creative way. It is interpreted [8], used in unanticipated ways [28], adapted [32] and appropriated in relation to diverse work practices. If the 'clay of computing' is understood as the computer application as it is used [7], the creative and conscious embedment can be called design as well. 'Use is design' was the radicalization of this understanding [1].

As a more complex understanding of use developed, the support for flexibility in use became an issue for Human Computer Interaction. The possibility of object oriented, graphical user interfaces, the desktop metaphor, the tools and materials metaphor, [12] designing props to be used when necessary [4] – all these design concepts aim at supporting the user while leaving freedom for localization and appropriation, for situated use. Tailorability has become a subject across scientific communities. [22, 18, 25, 11] These techniques allow for bringing design, in a more conservative understanding, into the use context.

[2] The concept of 'design in use' as we discuss it here has links to the distinctions made by Argyris and Schön in *Organizational Learning* [2] between espoused theory and theory-in-use. Due to the lack of space, we cannot explore this interesting connection further in this article.

With the development of computer applications to support cooperative work, and, even more, with the use of networked applications as an infrastructure for data centered business and administration, the relationship between design and use seems to shift again. Work and business practices – in our cases, the provision of services – are intrinsically related to the supporting technical infrastructure. The evolution of the Internet (and various local and regional intranets) has changed the scene even more, blurring the boundaries between content and form, and, therefore, between users and designers.

Participatory design has to be taken beyond the scope of a normal development project. After presenting and discussing practices of design in use we observed in a joint research project, we conclude with what we see as important implications for participation of different actors in the ongoing co-development of service provision and supporting technology, and the methods and techniques to mediate this co-development.

EVOLVING PRACTICES OF DESIGN IN USE

We have studied use and design of supportive technologies for public services. These studies have been carried out as part of a three-year research and development project, *Design of IT in use - supportive technologies for public services* (DitA)[3]. Development of provision of public services is intrinsically related to the further development of supporting and enabling infrastructure. Service provision and computer support are so intertwined and interdependent that the development of one implies the further development of the other.

The interdisciplinary cooperation between the department of Human Work Science and Media Technology and the department of Software Engineering and Computer Science, within the framework of this project, allows us to relate organizational, work practice, and technical development and participatory design without unduly reducing the complexity and tensions between these various perspectives. Using ethnomethodologically informed ethnographic field studies, including methods such as observation combined with video-recording as a tool for detailed interaction analysis, we are studying work practices of service providers and the cooperation between service providers and software developers designing and supplying applications for service provision. This methodology we combine with an action research oriented Scandinavian approach, using various methods such as workshops together with users, in order to support and ensure user participation in the design of public services on-line.

In this section, we take a closer look at practices of design in use in two of the municipalities in the DitA project, Ronneby and Sölvesborg[4]. The practices we present show concrete examples of the co-development of software, organization and work practices. In their concreteness, they raise a number of issues, which we will return to in the section thereafter.

In Ronneby; designing sets of possibilities

Ronneby was one of the first Swedish municipalities to launch its web site on Internet (in the spring of 1995). Since January 1999, the municipality has run its own intranet, with links to information on the public web. Routines are being introduced to allow all departments to be responsible for publishing their own content and services. During our study, the municipality had chosen to successively implement *Intrainfo*, a platform for among other things an administrative application for Internet/intranet publishing. This application was being co-developed by representatives from the municipal information department and a systems developer from the software consultancy firm, TietoEnator, that was developing and marketing *Intrainfo*.

Most of the fieldwork in Ronneby was done by two third-year students of the MDA program,[5] who were writing their bachelor's thesis about local IT design in the municipality. [13] The study focused on a part of the application called *Intradok*, a document-management system which contains templates, that is, sets of rules for writing, displaying and storing various types of digital documents within the municipal organization and publicly. During a period of several months in the spring of 2001, we studied the on-going design and tailoring of *Intradok* to support the publishing of the municipality's personnel advertisements on the Internet and the municipal intranet. Here, we identified different levels of cooperative design practices.

Consultant and local co-designer cooperation

First, from our point of view, there was the design work going on in close cooperation between the consultant/sys-

[3] Funded by the Swedish Agency for Innovation Systems VINNOVA, April 2000 - December 2002 (project no. 2001-03659). The partners are five municipalities, two software consultancy firms, a Call Center and us researchers at the Blekinge Institute of Technology.

[4] In reporting from this project, we have jointly agreed to use the real names of the involved partner organizations, but fictive names for individual persons in the different cases.

[5] The MDA program is a master's program at Blekinge Institute of Technology where Work Science and Computer Science are combined in educating future systems developers. MDA is the Swedish acronym for *People, Computers and Work*.

tems developer, Martin, and the chief of information in the municipality, Lena. Martin mainly worked at his home office in a city some 350 miles northwest of Ronneby by car. Thus, although he visited the municipality once a month on an average, most of the cooperation with Lena was carried out by phone, supplemented, if necessary, by the use of *pcAnywhere ä* , an application for accessing and temporarily taking over control of a local network-based PC application from afar.

The telephone and computer communication sessions turned out to be teaching and feed back sessions at the same time. For example, Martin showed Lena how to set up a new template for a specific set of documents, together with the related rules for access and editorial rights. Going through the possible choices, Lena wanted to be able to assign the same rights to people with different organizational roles, that is, connect several roles to one access profile. She gave several concrete examples of when and why this might be necessary. As this was not possible to do in the existing application, Martin made a note to allow for it in the next version. He had not taken into account the organizational structures and practices motivating this need until Lena pointed them out to him. Expertise shifted back and forth between them during this mutual learning process.

Martin's highly evolutionary way of developing the software enabled him to flexibly react on requirements from the few pilot users spread out over several municipalities. Lena was one of them. She appreciated the co-operation and was enthusiastic about being able to contribute to a useful tool for her organization. Some other municipalities who did not co-operate as closely with Martin had difficulties with the frequent changes and delays caused by his unconventional development practice.

Local analysis and reorganization inform on-going design

The organizational analysis and design work was going on locally in different departments. The work which was to be supported by the new system was being discussed and, to some extent, reorganized. This was seen not only as reorganization of work processes to fit new technologies, but as analysis work necessary for informing the on-going design and development of *Intradok* in order to fit it to the work organization in Ronneby. Here, besides the chief of information, Lena, there were three personnel secretaries in the municipal organization involved, Anna, Eva and Marie.

Until now, the normal procedure had been that Anna, Eva and Marie received the information about help wanted within, and wrote the advertisements for, their three different functional areas in the municipal organization. They then sent these ads via e-mail to Lena, who edited them and published them on the Internet/intranet. With the implementation of *Intradok* in the organization, this would be changed, such that the personnel secretaries could in future do their own editing and publishing of digital documents.

During a participatory workshop, the three personnel secretaries discussed their current routines, compared their different ways of working, and designed new routines with the help of *Intradok*. As they had never before compared their practices, they regarded these discussions about different ways of working as useful and rewarding. The participation in the tailoring of the new tool allowed them to reflect and consciously change their own routines and practices.

Who is designing what for whom?

Who, then, was the designer of the Ronneby version of *Intradok* being developed? The consultant, Martin, was designing an application to fit the needs of Ronneby municipality. But this application was being deliberately developed to afford and support future local design and development of the technological infrastructure in the municipality. The municipal chief of information, Lena, in cooperation with Martin, was designing an organizational infrastructure and delimiting and creating future design space for public services on the Internet and the local municipal intranet. The three personnel secretaries, Anna, Eva and Marie, were designing templates and a standardized framework for digital municipal employment ads and policies, making use of the space that Lena rigged and delimited for this purpose in *Intradok*. Looking in the other direction, we see that feedback from the local design processes in Ronneby was informing the overall design of the generic application *Intrainfo*, of which *Intradok* is a part.

Is this participatory design?

In what sense were we seeing participatory design in Ronneby? Mainly in the cooperation between the municipal chief of information, Lena, and the consultant, Martin. They carried out a number of design sessions together, usually by phone and with the support, when necessary, of the remote access and control facilities of *pcAnywhere*™. When it came to the design work of the three personnel secretaries, ideas and experiences were shared and explored amongst them during the workshop. This was the first time they had discussed their ways of organizing their work together, even though their offices were next door to each other. They were surprised to discover how differently they worked, and realized they could learn a lot by sharing experiences and ideas.

Today, Ronneby municipality is developing an organizational structure to support decentralized participation in design, adaptation and use of the common information infrastructure. The successor of Lena (who has moved to another job) is building up a committee of what can be called 'shop floor IT managers' in different departments, so that local interests can be considered and so that as much development and implementation of the IT infrastructure as possible can be delegated to the individual departments that will use it in their everyday work practice.

In Sölvesborg; "The designers? That's us!"

In Sölvesborg, we have been studying the use and development of front-office computer support in a public service one-stop shop (*medborgarkontor*, in direct translation 'citizens' office'). The one-stop shop is centrally located, in the entrance of the town hall. It offers information and services to citizens of the municipality as well as to visitors from out of town. A team of public service guides staff the one-stop shop, answering questions and helping out, either face-to-face, by phone, via e-mail or, in some cases, by internal or regular mail. The one-stop shop team is responsible for keeping much of the municipal information on the Internet and the municipal intranet updated, and for the further development of public information and services on the municipal website. The main motivation for this is that they are well acquainted with what kinds of information people ask for and need. As they use the Internet/intranet themselves all the time on the job, they are aware of design and accessibility issues.

During our field-studies of IT in use in the one-stop shop, we researchers implied to the head of the one-stop shop, Helena, that we would like go a step beyond the front-office staff, and talk to some of the technicians and systems designers. '*The designers? That's us!*' was her immediate and spontaneous reply. For a group of researchers aiming to use a participatory design approach throughout our research and development project, this was an extremely inspiring answer to get from the would-be 'participant' side. But it was also a serious challenge to our current worldview. On the one hand, it indicated the users' active and responsible involvement in on-going IT development processes in the municipality. On the other hand, it became obvious that we were dealing, here, with several different understandings of what it means to design technical support for front office work.

Choosing what applications to buy

On the level of choice of what applications to buy, install and use, the work team in the one-stop shop in Sölvesborg has developed a pragmatic approach. In 1992, when the one-stop shop was inaugurated as one of the first of its kind in Sweden, most of the applications accessible via the municipal network were mainframe systems, supplied by the main national dealer in software for municipal administration at that time. Today, the front office team uses the Internet/intranet, regularly accessing and using more than 20 different applications from 17 different software providers[6]. One of the most recent acquisitions is the new computer support for the telephone exchange. This application was chosen from a number of offers because the supplier was the only one who not only promised that the application could be usefully integrated with the existing computer support, but was actually able to prove it in practice. In the purchasing process, the front office work team set up the main functional requirements and, in the end, made the final choice between different available systems. The municipal technicians gave them advice about technical aspects of the various systems offered, based on the overall IT strategy in the municipality, network capacity etc. The front office team has gained considerable experience during the past few years in specifying their needs and purchasing necessary applications to further develop their computer support. At the level of analyzing needs, exploring options and deciding on what new pieces to add to the puzzle of different applications in use, their claim of being 'the designers' seems indeed to have substance.

Designing the services along with the technical support

Beyond that, shifting our main focus, for just a moment, from software to service provision, it seems that the front office work team is deeply and daily involved in designing and developing public services. Here, too, they have a point in saying '*The designers? That's us!*'

Taking part in design through user feedback processes

But even narrowing our focus to software design of specific applications, we have found that there are interesting things going on in and around the one-stop shop in Sölvesborg. One of the most frequently used applications is a niche application for booking locales (tennis courts, conference rooms etc.), an application which has been developed by a small software consultancy firm in the region. When asked what parts of the current computer support they find most useful, functional and well designed, this is the application the front office team uses as the best example. The consultancy firm keeps in contact with their customers, municipalities and associations all over Scandinavia, and provides support both via telephone, via their website on the Internet, and via visits. They have customer support meetings, where problems and new ideas are discussed and prioritized, between 8 and 10 times a year. The processes of continual support, take-up on customer feedback and further design and development, which this firm cultivates, may well be a large part of the reason for their successful product. They produce approximately 15 – 20 new versions of their basic application per year. These are continually being provided to all customers via the firm's website, with descriptions of 'what's new'. This allows their customers to choose for themselves whether the newest version is one

[6] At the time of our latest count, and not including all the more or less invisible middleware that keeps the network going. Basically, we counted the program icons on their digital desktop, and checked that these were what they themselves perceive as the applications they use.

they need to download or not, depending on what new functionalities have been added.

Through the customer feedback processes, there is apparently some substance to the Sölveborg front office team's claim of being their own designers, even here. Admittedly, they represent only one of some 250 customers giving continual feedback about the product. However, it is clear that they themselves feel that they have been able to act as co-designers in the case of their most appreciated application, and that they still have a co-constructive role in its continued development.

Recent development in Sölvesborg has lead to the front office team earning a more official status in the organization as local designers of the municipality's intranet. They are consultants for other departments in how to use the existing possibilities, discussing and coordinating improvements.

ISSUES RAISED BY DESIGN IN USE

The practices we have described here reveal a shifting responsibility for the observed design in use. As agency shifts, the object of design changes character as well: the supporting software, its adaptation, the whole infrastructure for service provision. The computer applications become a boundary object [29] for multiple design practices/activities. Some of the observed practices look much like tinkering [9], that is, in an ad hoc way making heterogeneous applications work together. However, there is practice- and experience-based deliberation and judgment behind both what is in use and what is considered necessary to implement next, as we have seen in the Sölvesborg case. The sense of ad hoc-ness lies, rather, in the fact that observed practices seem often just to take place, unaccounted for, not supported by the formal organizational structure or allotment of resources.

Would an organizationally defined function and structure for 'shop floor IT management' [14] be a way of making these design and development activities, and the multiple and shifting foci of design they represent, more visible and organizationally legitimate? Something to this effect seems to evolving, in different ways, both in Ronneby and in Sölvesborg. If so, what should professional 'shop floor IT management' look like? What does such an overlap and intertwine of use, design in use, maintenance and development require of software development? We can design software in ways so it can be easily adapted to certain changes in work practice. How does that influence the distribution of design work between computer professionals and different groups of local co-designers/web designers/ service providers/users/citizens?

As we explore these topics in the following, we deliberately do so as researchers coming from two different research areas. Two of us have a background in Software Engineering and Computer Science, and thus focus mainly on software development processes, models and methodologies for use-oriented design of software. The third has a background in Work Science and Informatics, as well as work-life experience from white-collar office work and IT consultancy. Jointly, we are striving for a constructive dialogue between different standpoints concerning design of IT in use. At the end of the section, we bring together the challenges we see for participatory design in the evolving practices we have been observing.

Shifting Foci of Design

What, precisely, we mean by design, then, depends on from what standpoint we are viewing information technologies. Traditional systems development and computer science perspectives take a narrow view of design, defining it as the modeling process between requirement analysis and the actual coding of the computer application. Newer programming methodologies have stretched the concept of design to include the coding process, and evolutionary design is often understood as including the entire lifecycle of the application [15]. Even in evolutionary design, however, the *active agents* of design are normally seen as being professional software developers or participatory designers, situated within a systems development community of practice – usually a software consultancy firm, or an in-house IT department.

What we have observed during our field studies in the DitA project indicates that there are other people out there, in a number of different communities of practice, who are actively involved in the design of various aspects of the computer support for public service provision. From the point of view of the municipal service providers, whose work practices we have been observing, there are a large variety of designers involved in the development of their computer support. There are local technicians designing and managing the technical network. There are local co-designers cooperating with consultants and/or in-house municipal IT departments in developing and customizing various web-applications. There are, among the front office service providers themselves, as well as elsewhere in the municipal organization, local web-designers designing and maintaining web-sites, design work that often includes modeling and developing shared on-line databases, templates etc. And, as we saw in the one-stop shop in Sölvesborg, front office service providers are also, in some cases, designing their own computer support on a meta-level, having been given the authority and responsibility of choosing what applications to buy and make use of.

As the focus shifts, we see, beyond 'pure' software design, a number of on-going design practices involving IT in use. We see services being designed, on-line or off, but usually involving IT, in one way or another. We see constellations of different off-the-shelf applications being designed, individual applications being further developed and tailored, and whole technical infrastructures thus being designed and developed in a distributed, yet often locally cooperative way.

Who is responsible for these design processes, and for taking care that they are carried out in a cooperative way?

Design for Change

The possibilities for users' participation in design, and for the continuation of design, once a device is taken into use, depends not only on organizational circumstances, but also on the technology developed and used. Because of its malleability, for example, software allows for evolutionary prototyping for the integrated co-development of design and use. Still, to accommodate different people in different roles and with different foci appropriating the software to the developing work practice and service provision requires a change in perspective also in software development and design. Software development is often perceived as producing a 'solution' for a 'problem'. A 'design for change' perspective puts the support of work practices in focus, work practices that are expected to change in anticipated as well as in unexpected ways.

Software that is part of a complex technical infrastructure, like in the cases presented above, has to be designed in such a way as to allow for design in use. The goal is no longer a fitting application for a specific use context, but software that can be related to different work practices and service provisions, and that can be adapted if and when necessary.

Taking change into account from the beginning requires a different way of thinking. Changes and different kinds of use practice have to be anticipated. Different techniques to provide for adaptability have to be evaluated with respect to the specific circumstances at hand. What adaptations can and should be done by which users? What role can a local developer or a systems administrator take over? How to provide for easy maintenance? Here, use, development and technical contexts, as well as the interaction between them, have to be taken into consideration [11].

Today's design methods offer very little guidance concerning how to provide space and support for the cooperation of users, local developers, and computer professionals in on-going design. Even participatory design methods primarily focus on fitting support for specific work practices, rather than design for change.

Shop Floor IT Management

During earlier field studies of work practices in one-stop shops, carried out in 1992 – 1996, before the Internet had had any real impact on the computer support in use, we found that there was a sizable gap between declared IT strategies – which were often very visionary – and existing organizational infrastructures for supporting everyday use of IT in the municipal organizations we were studying [14].[7] In order to bring this gap into focus in on-going strategic discussions about IT on a managerial level, as well as in our research work, we began to talk about *the art* of *shop floor IT management*. Shop floor IT management, in this context, was seen as the everyday work of making IT work, that is, the mundane, on-going problem-solving, tuning, tailoring, further development and design in use of the existing computer support, and the integration of new applications into this existing environment. Ideally, IT in use in an organization with a well developed IT strategy would be a self-lubricating and self-enhancing system, with the feedback from users directing the work of shop floor IT management.[8]

At that time, we located the responsibility for the gap we detected between stated IT visions and actual IT use (and misuse, or non-use) with management and in-house IT departments in the municipalities we were studying. Here, we felt, there should be technicians and local designers involved in help-desk and tailoring activities, supporting the adaptation of IT in the everyday work practices throughout the organization. This was an infrastructure that seemed to be largely lacking.

In our more recent field studies, carried out during 2000 and onward (the DitA project is still on-going), the issue of shop floor IT management is still highly relevant. There is still a gap between officially stated managerial IT strategies and what is actually being accomplished with IT within the organization. However, when it comes to IT design agency, the situation in the municipal organizations we are studying is more diverse and complex than it was before the Internet, and various intranet solutions, became common. As we have shown with the examples in this paper, today there are design activities going on in many different parts of the organization, involving many different categories of users as active designers/co-designers. Technicians, web-designers, service providers – there are many people, and groups of people, involved. Thus, in some sense, shop floor IT management is actually going on, right out there on the shop floor. But it is not officially accounted for, nor is it supported by organizational and technological infrastructures, and given resources, in proportion to its apparent

[7] These studies were mainly carried out as part of the research project *Working at the front – skill, cooperation and computer support in public service one-stop shops*, which was financed by the Swedish Council of Work Life Research (project number 94-0349).

[8] Similar participatory and cultivating approaches to IT in use have been explored for by others. [22, 8,17, 32]

relevance for smooth everyday use of IT in getting the day's work done.

Reconsidering Software Processes

The described interlacing of design, development, use and purchase requires new and alternative ways of organizing software development. In both case studies, the practice of the software developers involved has been unusual if not contradictory to what is considered state of the art in software engineering textbooks.

The highly iterative and cooperative development practices with close feed back cycles between Lena and Martin in the Ronneby case ensured that the spaces for adaptation are designed to accommodate municipal practices. According to software development standards they are anarchistic and unmanageable. The development practice at the favorite software provider of the one-stop shop staff in Sölvesborg is another example. The close interaction with the users that results in frequent versions that can be downloaded if needed, is not accounted for in the organization of customer developer relationships as taught at university courses. But would a software project starting with a defined set of requirements have been able to accommodate the co-development of technical infrastructure and service provision we see here?

Evolutionary software process models like STEPS [15] can capture part of the initial dynamics of the introduction of new software. They have been criticized, as being not applicable in commercial settings as there is no previously defined project goal. Extreme Programming, developed as an answer from practitioners to more and more rigorous project management strategies, now proposes similar ideas: tight iterative releases that can be taken in use from the very beginning, the possibility to adjust the requirements and project goals after each release, and an end user on site. [3]

The observed practices of design in use seem to ask for even more radical re-conceptualizations of software processes. New developments of applications intertwine with use, maintenance, tailoring, adaptation and further development. To focus on an isolated controllable development process and regard the rest as - not so important - operation and maintenance, ignores the changing way in which software is implemented and used. (See also [6])

Ways to coordinate and manage such patchworks of design activities as we were able to observe in our case studies are still to be developed. Understanding software design as networks of decisions in relation to use, technical and development contexts [16] can provide a starting point. A more realistic way might be to understand development tasks, design in use and use as parallel activities with shifting intensity and shifting main actors. This would allow for maintaining continuity in co-operation between minor tasks that can be handled as part of everyday operative support and bigger chunks of development of maintenance work organized in projects and under the leadership of software developers. The coordination of these networks of activities can only be achieved in close continuous cooperation between users and developers.

PARTICIPATORY DESIGN BEYOND THE PROJECT

The when and where of participatory design has often, explicitly or implicitly, been set by the software design process, which is usually run in project form.[9] Agency, roles and terms of responsibility have tended to be defined within this framework. Although software design projects are undeniably an important arena for participatory design, the examples given above indicate that cooperative design is actually going on in a lot of other contexts as well.

By starting with a focus on existing work practices and IT in use in a number of specific work places, rather than on a software development project, we gradually came to change our understanding of design, and, consequently, to question some of the assumptions underlying the basic framework and methodologies of participatory design. If design is seen as continually on-going in many different locations and forms, and intricately interwoven with use, rather than as primarily contained within software development projects, this raises several important issues for participatory design.

Within the software development community, it highlights software flexibility, adaptability and sustainability – design for change. It points towards the need for reconsidering software design processes, and developing methods for linking them more closely and continually to user feedback and rapid and efficient version management, for example. But both within and beyond the software development community, it brings into focus issues of coordination between use, design in use, adaptation and development.

From a broader organizational perspective, there are practically no formally visible infrastructures or resources for what we call shop floor IT management, that is, support for local adapting, tailoring, tuning, and continual design and development in use of IT. Focusing on shop floor IT management raises issues about how to make the on-going 'participatory design in the wild' more visible, and give it support within the existing organization, for instance in the form of standards, methodologies, modeling languages and other means of representation for cooperative development

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[9] The primarily project-oriented focus of participatory design may well be more pronounced in Scandinavia than elsewhere. It has been questioned previously by researchers in Britain and North America, in responses to the 'Scandinavian Challenge'. [23].

and – not the least – personnel resources. Surely, methods from participatory design could be more consciously and deliberately explored, adapted for, and applied in, these contexts.

Participatory design has hitherto mainly been an issue for the software development community and, traditionally, in Scandinavia at least, the workers' unions. Today, more than ever, we believe it is an issue for everyone. Practices of design in use challenge traditional concepts of designer/user roles as well as concepts of what it is that is the object of design, and in what contexts design takes place. To whom should we teach our methods, and what can we learn in the process?

CONCLUSION

We have gone out into the field to study IT in use. In so doing, we have gradually become aware of what we have called, provocatively, 'PD in the wild'. Modern IT networks, with a variety of applications from different software providers, new web-design tools, and the integration of customization processes with on-going version management, are just a few of the developments which appear to be providing a base for the evolving practices of design in use we have observed.

When Hutchins challenged cognitive theory by using anthropological methods to explore 'Cognition in the Wild' [19], he was challenging a whole conceptual framework. We started, more tentatively, by asking ourselves what our findings might mean for methods and practices of participatory design. But we found, as we explored these issues, that we were in some sense beginning, like Hutchins, to challenge the framework. Others have challenged participatory design to move beyond a certain set of organizational structures, claiming that traditional participatory design doesn't accommodate small companies, or networked organizations, for instance [27, 31]. In this article, we have attempted to broaden the when, where, and how of design, and take participatory design beyond the software development project. We have explored how we can bring a multitude of different perspectives on design, and a multitude of different kinds of design and designers, into the overall picture and understanding of on-going design and development of IT and – in our case – public services.

Participatory design is, as we see it, no longer primarily a professional issue for software developers, but has to be extended to the relationships between different user-designers, and, beyond that, between them and their clients/customers/service-seeking citizens in general. As technological and organizational infrastructures change, participatory design has to change, too. Within the DitA project, we are now exploring these issues further in two directions. On the one hand, we are studying the local cooperation between web-designers and service providers, and between citizens and service providers, to see how participatory design methods can be adapted and used in these contexts. On the other hand, we are taking a closer look at 'unorthodox' methods of participatory design in use between systems developers and users. Thus, the field studies at the consultancy firm that has developed the favorite application of the front office team in Sölvesborg are still on-going, and here we are now looking more specifically at issues around *designing for* design in use, i.e. processes and methodologies for supporting use-oriented design of flexible and adaptable systems.

Issues we are continuing to explore jointly and in depth in our interdisciplinary research cooperation around IT and public services are; means of representation for participatory co-development of services and technology, issues of accountability, methods for on-going participatory design, design for change, and new ways to integrate design, development and use of technology. In one way or another, these questions all have to do with developing sustainable organizational support for 'PD in the wild', that is, domesticating and cultivating participatory design in everyday use of IT.

As for the initial question in our introduction; '*What, precisely, do you mean by design?*' we don't really expect we will ever be able to agree on one answer.

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Seeding, Evolutionary Growth, and Reseeding: Enriching Participatory Design with Informed Participation

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ABSTRACT
Historically, *participatory design (PD)* has focused on system development at design time by bringing developers and users together to envision contexts of use. But despite the best efforts at design time, systems need to evolve at use time to fit new needs, account for changing tasks, and incorporate new technologies. In this paper, we argue that systems should be designed as *seeds* that are able to evolve.

The *evolutionary growth* of the seed is driven by *informed participation*, in which active users explore complex design problems and, in the process, create new information. When evolutionary growth can no longer proceed efficiently, a *reseeding* phase is required to organize, formalize, and generalize information so that it may support a new period of evolutionary growth.

Informed participation requires social changes as well as new interactive systems that provide the opportunity and resources for social debate and discussion rather than merely delivering predigested information to users. This paper presents key issues for designing new media in support of informed participation. These issues have been explored through several applications of the *DynaSites* system in contexts including collaborative design and courses-as-seeds.

Keywords
informed participation; seeding, evolutionary growth, reseeding; collaborative design practices; meta-design; open systems; evolving information repositories; courses-as-seeds; consumer and designer mindsets

INTRODUCTION
Cultures are substantially defined by their media as well as their tools for thinking, working, learning, and collaborating. Much of the new media is designed to regard humans only as consumers, television being the most obvious medium promoting this mindset and behavior [26]. Unfortunately, a consumer mindset [9] does not remain limited to television, but in many cases extends to other activities and domains in our culture.

Our research interest is in designing the social and technical infrastructures in which new forms of collaborative design can take place. For most of the design domains that we have studied over many years (ranging from urban design to graphics and software design) [2], the knowledge to understand, frame, and solve problems is not given, but is constructed and evolved during the problem-solving process [32]. *Informed participation* [3,4] is a form of collaborative design in which participants from all walks of life—not just skilled computer professionals—transcend beyond the information given [5] to incrementally acquire ownership in problems and to contribute actively to their solutions [33].

This paper addresses the ongoing enhancement and evolution of conceptual frameworks and information environments to support informed participation. We have explored this in (1) design and design environments [11], as well as (2) courses-as-seeds and course information environments [6]. *Courses-as-seeds*, an innovative approach to learning, is used in this paper as our exemplary domain.

CONCEPTUAL FRAMEWORK
Our conceptual framework attempts to use the seeding, evolutionary growth, reseeding (SER) model to broaden the historical focus of participatory design (PD) beyond the initial design of a system. It addresses some of the challenging unresolved issues of PD by demonstrating that no real borders exist between design practice and practice of use, and that these phases are highly related if informed participation is supported.

Seeding, Evolutionary Growth, Reseeding Model
The SER model [12] is a descriptive and prescriptive model for large evolving information repositories. It postulates that systems that evolve over a sustained time span must continually alternate between periods of activity and unplanned evolution, and periods of deliberate (re)structuring and enhancement. The SER model is based on the observation that design problems in the real world require *open systems* that users can modify

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and evolve. Because design problems cannot be completely anticipated at *design time* (when the system is developed), users will inevitably discover mismatches at *use time* between their problems and the support a system provides.

The SER model encourages system designers to conceptualize their activity as *meta-design* [14], thereby aiming to support users as designers in their own right, rather than as passive consumers of systems and information. In this perspective, users are seen as knowledge workers [8] who do design and solve problems, as well as designers in use [17] who modify their systems as needed to suit their purposes.

We have explored the feasibility and usefulness of the SER model in the development of domain-oriented design environments [11], organizational memories [19], course information environments [6], and open systems approaches [14,27]. The evolutions of these systems share common elements, all of which relate to sustained knowledge use and construction in support of informed participation.

Seeding. In the past, large and complex information systems were built as "complete" artifacts through the large efforts of a small number of people. Conversely, instead of attempting to build complete systems, the SER model advocates building seeds that can be evolved over time through the small contributions of a large number of people.

A *seed* is an initial collection of domain knowledge that is designed to evolve at use time. It is created by environment developers and future users to be as complete as possible. However, no collection of knowledge can be truly complete due to the situated and tacit nature of knowledge as well as the constant changes occurring in the environment in which the system is embedded [36,39]. No absolute requirements exist for the completeness, correctness, or specificity of the information in the seed. In fact, the shortcomings in these respects often provoke users to add new information to the seed.

Evolutionary Growth. The evolutionary growth phase is one of decentralized evolution as the seed is used and extended to do work or explore a problem. In this phase, developers are not directly involved because the focus is on problem framing and problem solving. Instead, the participants are those stakeholders who have a direct stake in the problem at hand.

During the evolutionary growth phase, the seed plays two roles simultaneously: (1) it provides resources for work (information that has been accumulated from prior use), and (2) it accumulates the products of work, as each project contributes new information to the seed. During the evolutionary growth phase, users focus on solving a specific problem and creating problem-specific information rather than on creating reusable information. As a result, the information added during this phase may not be well integrated with the rest of the information in the seed.

Reseeding. Reseeding is a deliberate and centralized effort to organize, formalize, and generalize information and artifacts created during the evolutionary growth phase [35]. The goal of reseeding is to create an information space in which useful information can be found, reused, and extended. As in the seeding phase, developers are needed to perform substantial system and information space modifications, but users must also participate because only they can judge what information is useful and what structures will serve their work practices.

Reseeding is necessary when evolutionary growth no longer proceeds smoothly. It is an opportunity to assess the information created in the context of specific projects and activities, and to decide what should be incorporated into a new seed to support the next cycle of evolutionary growth and reseeding. For example, open source software systems [27] often evolve for some time by adding patches, but eventually a new major version must be created that incorporates the patches in a coherent fashion.

Informed Participation

Informed participation attempts to address the open-ended and multidisciplinary design problems that are most pressing in our society. These problems, which typically involve a combination of social and technological issues [15], do not have "right" answers, and the knowledge to understand and resolve them changes rapidly, thus requiring an ongoing and evolutionary approach to problem solving.

Informed participation involves a *community of interest* [10] made up of people from several backgrounds, each having a unique stake in a common problem. Participants are engaged in both learning and contributing activities. New knowledge is constructed when learning and contributing feed each other, ultimately producing a greater shared understanding than could be achieved by each of the participants individually [29].

Informed participation shares many objectives with *participatory design* [33], which aims to involve users in the design of artifacts they will use. Our approach emphasizes *mutual learning* for sharing the unique knowledge that each participant brings to the design problem, and *evolution-based design approaches*, in which problem framing and problem solving are intertwined [32]. Another key emphasis of informed participation is leveraging prior and related design efforts to serve as a sources of problem-solving knowledge. Although no two problems are exactly the same, similar problems can provide valuable insights that help to understand the problem at hand. In this spirit, the outcomes and products of informed participation are seen as potentially valuable resources for future reuse and are accumulated for this purpose. Informed participation begins where traditional participatory design of an information system leaves off, and extends into the system's lifecyle as the focus of participation shifts from designing a system to using and evolving it [12,17,25].

Informed participation is impossible in communities in which most of the members regard themselves as consumers [9]. Individuals within communities must be encouraged to evolve into *power-users* [23], who not only use artifacts and information, but also modify and extend them [20]. Individuals (acting as designers) must acquire a new mindset—they no longer are passive receivers of knowledge, but need to be active researchers, constructors, and communicators of knowledge. Knowledge is no longer handed down from above (either from specialists in design, from managers in organizations, or from teachers in courses), but is constructed collaboratively in the context of work [31].

Informed participation is based on the fundamental claim that one of the major roles of new media is to provide the opportunity and resources for social debate and discussion [1], rather than to merely provide access to predigested information. Designing systems for informed participation has several dimensions: (1) a *social* dimension of designing new social practices and processes [7]; (2) a *cognitive* dimension, requiring an understanding of the interference between solving a task (or building an artifact) and documenting work so others can build upon it [22]; and (3) a *technical* dimension of creating new media that allow participants to contribute new information without acquiring extensive technical skills [14].

Information environments for informed participation must support the following activities:

- *Building, Referring, Extending.* As opposed to delivering existing information to users, systems for informed participation should enable users to contribute their knowledge and expertise by extending the current state of knowledge or an idea expressed by a peer. The goal is not merely to accumulate information but to construct new knowledge collaboratively, leading to "living" information spaces [37].
- *Formalizing, Restructuring, Reusing.* The products of each project or design session contribute to a larger accumulation of information relevant to the problem domain. The goal is not for the system to contain complete solutions to problems, but rather for it to accumulate resources that enable users to generate new ideas—to go beyond where they could have gone if they had started from scratch [13,34].

Enabling evolution and sustaining informed participation over extended periods of time requires not only systems that are able to support communication and accumulate information, but also *a process model and mechanisms to improve and refine the accumulated information so it can inform future design tasks.*

APPLICATION DOMAINS

To gain a deep understanding of the challenges and possibilities associated with informed participation, we have explored the concept in several application domains, including collaborative design [1] and courses-as-seeds [6]. This section briefly discusses informed participation in urban design, and then goes into more detail about courses-as-seeds.

Collaborative Design

To move beyond frameworks that are based solely on providing access to existing information, we have been developing the Envisionment and Discovery Collaboratory (EDC) [2]. The central theoretical vision of the EDC is to provide contextualized support for reflection-in-action [32] within collaborative design activities. The EDC combines an *action space*, implemented as a game-game-board on which physical objects are placed by the users and sensed by an underlying simulation, with a *reflection-space*, implemented as an open-ended information environment that holds and manages the considerable amount of information required to understand complex situations and alternate perspectives. In Figure 1 the horizontal surface is the action space and the vertical surface is the reflection space.

Figure 1: The EDC Environment

The shared physical context provided by the EDC environment helps people to articulate their knowledge and communicate with others [7]. The EDC provides a physical representation through which users can express their views, learn other views, and coordinate these views. As an engaging forum, the EDC motivates participation and gives problem owners a voice in framing problems.

Table 1: Comparison of Courses-as-Seeds and Traditional Courses

Courses as finished products	Courses as seeds
Students answer problems given to them by the instructor	Participants construct knowledge about topics that are personally meaningful
Students interact mainly with the teacher and compete with other students for grades	Participants are a community of practice and collaborate to build shared understanding
Students are complete novices in the subject matter and make no contribution to other students	Course participants are knowledgeable people in their own working environments and have much to offer
A course is given over a period of years, more or less in the same form	A course is considered as a seed that will evolve continuously
Students are recipients of knowledge (the assumption is that the teacher/instructional designer has all the relevant knowledge)	Participants are not just passive recipients of knowledge, but active contributors, (i.e., they actively co-design the class curriculum)
From time to time the teacher/instructional designer will incorporate new ideas into the course so the course doesn't become outdated	The content of the course is enriched through the interaction of knowledgeable people, and important and relevant additions are incorporated into the course before it is taught the next time

As a reflective information source, it captures important information not anticipated at system design time, integrates new knowledge with existing knowledge, and aims to actively deliver information to users when they need it.

The EDC is an explicit attempt to create an open, end-user modifiable system that users are able to extend during the evolutionary growth phase of the SER model. The EDC addresses some of the shortcomings of such closed systems as SimCity [21], in which the functionality is fixed at design time. For example, the only way to reduce crime in a simulated city is to add more police stations because that was the only alternative conceived by the system designers. Other solutions, such as increasing social services, cannot be explored. As a result, closed systems such as SimCity may be good tools for education or entertainment, but they are inadequate for actual planning tasks, as our empirical investigations have clearly demonstrated [2].

Simulations within the EDC are modified by using Visual AgenTalk (VAT) [28], a graphical end-user programming language. VAT enables EDC users to create new simulation objects and modify behaviors of existing objects, thus supporting evolution of the EDC seed to enable exploration of issues not anticipated during system seeding.

Courses-as-Seeds

Courses-as-seeds [6] is an educational model that explores informed participation in the context of university courses. The goal is to create a culture of informed participation that is situated in the context of university courses and yet extends beyond the temporal boundaries of semester-based classes. Courses are conceptualized as seeds, rather than as finished products, and students are viewed as informed participants who play an active role in defining the problems they investigate [30]. The output of each course contributes to an evolving information space that is collaboratively designed by all course participants, past and present.

Central to the courses-as-seeds model is the use of an information environment that enables each offering of the course to build upon the products of prior classes, as well as serving as a forum for class discussions and a workspace for projects. Evolutionary growth is driven by discussions and by projects that explore a problem or issue from a new perspective, ideally building upon the work of a prior project or class. The results of these activities are captured in the information environment.

Reseeding is an opportunity to reflect upon the learning that has occurred in the past semester and to set the initial course for the next semester. The work products from the semester are integrated with those of prior semesters to form foundation for the next semester. New system functionalities may be implemented in response to requirements exposed in the past semester.

The role of technology in the courses-as-seeds model is to form and sustain active design communities [38] in which participants contribute ideas from their own unique perspectives and connect them with ideas of their peers as well as with the work of prior courses. From this perspective, mere *access* to existing information and knowledge (e.g., seeing courses as finished products, either in the classroom or on the Web) is a very limiting concept that at worst leads to "consumer" cultures [9]. Table 1 compares the courses-as-seeds model with traditional courses and identifies the main characteristics of the approaches.

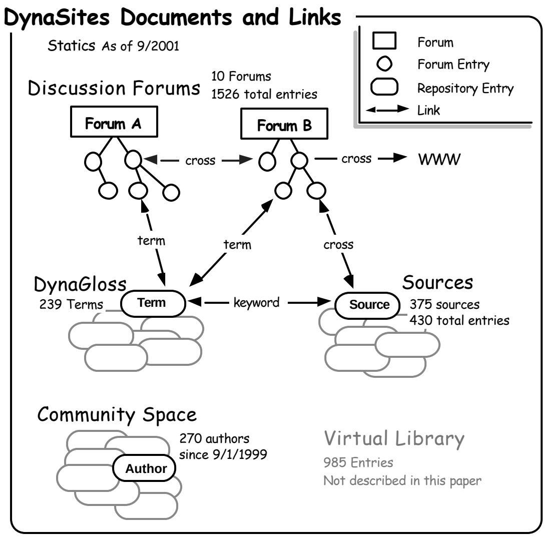

Figure 2: DynaSites Information Architecture

DYNASITES: SUPPORT FOR INFORMED PARTICIPATION

DynaSites [24] is an environment for creating and evolving Web-based information repositories in support of collaborative working, learning, and design. Information spaces created with DynaSites offer the following promises and opportunities for informed participation:

- They are owned by the people and communities who use them to do their work, not by specialists, management, or teachers [13].
- They are open and evolvable systems, serving not only as repositories of information, but also as *living* mediums of communication and innovation [37].
- They evolve through small contributions made by many people rather than large contributions made by few people [12,27].

We have used DynaSites to explore the implications of informed participation and the SER model in the application domains described above. DynaSites served as the reflection space for the EDC environment as well as a course information environment within the courses-as-seeds model. This section first describes the DynaSites system and then the use of DynaSites in the courses-as-seeds domain.

DynaSites Architecture

The DynaSites system houses many individual information spaces, called *documents*, each of which are extensible. Some documents are owned by a particular community, such as a university course or a research project, whereas others are shared, meaning they can be accessed and extended by all DynaSites users. DynaSites documents are influenced by the concept of *threaded discussion forums* [18], which have proven to be successful in mediating communication among communities of users. Threaded discussion forums are typically stand-alone information spaces; in contrast, however, DynaSites documents exist in a larger environment consisting of other community-owned documents as well as shared documents, each of which manages a specific type of information (Figure 2). The shared documents enable awareness of ideas and people across individual documents and thereby across the communities that own the documents.

The shared documents include:

- *Sources*, a shared repository for literature references. Each entry can be rated by users and is associated with its own discussion thread for comments and annotations.
- The *Community Space*, a repository of persona pages that hold information about DynaSites users. Persona pages are designed by users and contain information they wish to share.
- *DynaGloss*, a shared and extensible glossary of terminology. Each term can be annotated or redefined by any user.

The goal of DynaSites is to improve its information space over time by integrating the individual documents to form gateways to new ideas and new people. The documents in DynaSites are integrated by several linking strategies (Figure 2):

- *Term links* connect terms defined in DynaGloss with the entries throughout DynaSites in which the term appears. Term links are *automatically* created when a defined term occurs in the body of an entry.
- *Keyword links* connect keywords assigned by users to Sources entries with the corresponding definitions in DynaGloss.
- *Cross links* are manually created by users to connect any two entries in DynaSites, or to connect an entry to an arbitrary URL on the Web.
- *Author links* (not shown in Figure 2) connect all entries in DynaSites to the persona pages of their authors.

Although most of the links are automatically created and updated by the system, information must first be represented formally—in a manner that the system can interpret. For example, terms must be spelled identically to be automatically linked to corresponding glossary entries. Together, these linking strategies aim to create a rich web of information that connects ideas, people, and literature references. To provide an illustration of how DynaSites supports the SER model in the context of courses-as-seeds, we next describe our experiences with several courses conducted by the authors at the University of Colorado (course information is available at: http://www.cs.colorado.edu/~gerhard/courses/).

Supporting Courses-as-Seeds

DynaSites has been used to support several different courses taught at the University of Colorado at Boulder (for details, see [24]), most recently in a course entitled *Designing the Information Society of the New Millennium*, Spring 2000. The goal of this course was to allow participants to explore how new media will impact learning, designing, and collaboration in the information society of the new millennium.

Course activities consisted of readings, discussions, independent research, and a semester-long project. These activities were carried out within DynaSites. For example, participants were given questions for each reading and asked to post their responses in DynaSites prior to the classes in which that reading would be discussed. Projects also used DynaSites to coordinate, communicate, and store their products.

At the end of the semester, the course information space contained 362 entries. Analysis of the contents (for details, see [6]) revealed the following characteristics that limit its usefulness and usability for future participants:

- The responses to reading assignments often contained interesting insights but the entries were almost invariably named with a default title (e.g., "Re: Assignment 7"). This practice resulted in discussion threads consisting of up to 25 entries with identical names. This structure offers no indication of the contents of the entries and thereby virtually eliminates any chance that the interesting insights will be found by future participants;
- Related entries in different parts of the information space were only rarely linked together using the cross-linking functions provided by the DynaSites system. For example, the information from group projects were not linked to discussions of related reading assignments. In this sense, the information space fails to reflect the development of key ideas throughout the course;
- Literature references, URLs and key terminology—items that might have been formally represented in one of DynaSite's special-purpose shared documents—were instead embedded within discussion entries as plain text where they are invisible to the system's linking mechanisms and therefore less likely to be found by future participants.

In summary, the content and structure of the information accumulated during the semester was meaningful to the course participants but not to people who did not participate in its creation.

ASSESSMENT

Reseeding techniques and Issues

The information space characteristics described above illustrate that information generated during informed participation is specific to the contexts in which is it created, and therefore it may not be meaningful or useful in different contexts. For example, information structures that were created to store responses to reading assignments were naturally organized by assignment and by participant. Future users, however, are not likely to be interested in the assignment, per se, but rather in the entries that express a valuable point of view. The challenge for reseeding is to impose a more general structure on the information—one that makes sense to those who did not participate in its creation, and that brings related pieces of information together to increase coherence and provide new opportunities for extensions.

It is important to recognize that any reseeding operation has the potential to change the original meaning of information. For example, restructuring information can destroy the original context that contributed to the meaning of individual entries. Reseeding operations that destroy original information can also be seen as unfair to the creators of the information, especially if the creators do not participate in the reseeding process. Reseeding should therefore strive to create new information structures that provide access to the original information without actually modifying it.

For example, the cross linking mechanism in DynaSites can be used to create an annotated index of information about a particular topic. Such an index consolidates information that was previously scattered throughout the information space and provides a useful new structure without affecting the original information. Although DynaSites provides a mechanism to create cross links, its textual interface makes this process cumbersome. Systems aiming to promote graphical operations such as restructuring and cross-linking must offer better support for visualizing and manipulating structures.

Because a major goal of informed participation is to empower stakeholders to have as much control and ownership over their design process as possible, they should be involved in reseeding processes. We have not thus far engaged course participants in reseeding activities because a semester is barely enough time to get participants used to the courses-as-seeds model. An alternate view of reseeding, however, is as a way to *begin* the semester. In this approach, participants are introduced to the courses-as-seeds model by examining the products created by prior courses and collaboratively creating information structures that will be extended during the semester.

We are also exploring how to motivate participants to exercise more discipline when adding information to the seed. Performing tasks such as formalization and integration at use time is another way for participants to assume control and ownership over their design process, but this requires extra work which may not be seen as part of the original task, especially within the traditional culture of education. For example, students are often not motivated even to choose descriptive titles for their reading assignment responses, and instead accept the default title supplied by the system. People are naturally hesitant to adopt and learn yet another information technology such as DynaSites or to do additional work from which they may not personally benefit [16]. To engage users in reseeding activities at use time, the efforts required must be lowered (e.g., through improved tools), and the perceived benefits of performing the extra work, raised.

Toward a Culture of Informed Participation

Our initial experiences with the courses-as-seeds model have shown that technology alone will not bring about informed participation in the classroom. The courses-as-seeds model is grounded in educational theory [30] that challenges the established power relationships in a course. The instructor is more a meta-designer or facilitator who creates affordances for students to engage in informed participation. It is obvious that such fundamental changes will transcend the power of any technology. Although we believe that new technologies will be necessary to effectively support courses-as-seeds, they will definitely not be sufficient.

In a culture of informed participation, knowledge workers will see providing additional information as part of their work rather than as an extra task. A first step in this direction is to identify and encourage members of the community who are interested and inclined to become *power-users* [23]. These users are more willing to learn new mechanisms and can assume a leadership role within the community, helping others to see a benefit in formalizing and perhaps even helping them to learn how. The emergence of such roles is another indication of community formation and should be considered as an essential aspect of informed participation.

CONCLUSION

The core concern of informed participation is to understand how collaborative design processes can be based on participation of the people affected by the decisions reached, the artifacts built, and the technology designed. The application domains (collaborative design and courses-as-seeds) in which we have explored informed participation are design domains. Collaborative problem solving and decision making in these domains requires that a variety of stakeholders with different background knowledge and interests be brought together.

Informed participation (and its conceptual embedding into the SER model) represents a framework for participatory design that is concerned with:

- the collaborative interactions that take place during the *use and evolution* of a system rather than just the original design and development of the system, and
- *sustaining* the usefulness and usability of technology in use over extended periods of time.

Our experience with the courses-as-seeds model highlights the relationship between these two concerns. Informed participation produces new knowledge that could not be anticipated at design time, but rather can only be produced at use time in the context of solving real problems. Although informed participation is the driving force for evolutionary growth, a complementary participatory design process that aims to integrate new information (and potentially to enhance system functionality) is required for sustainability.

From the perspective of the SER model,

- *participatory design* in the past was mostly concerned with the seeding phase and a focus on the collaboration between user and developer, although attention has been paid recently to the transition from seeding to evolutionary growth (i.e., use practices);
- *informed participation* was originally mostly concerned with evolutionary growth (i.e., collaborative design among a community of interest), but recently we have been paying more attention to reseeding (e.g., sustaining informed participation through ongoing cycles of evolutionary growth and reseeding) and to collaborative interactions between end-users, power-users, and developers.

By supporting informed participation effectively, we address one of the fundamental challenges for participatory design and human-computer interaction research: to invent and design a culture in which all participants in collaborative design processes can express themselves and engage in personally meaningful activities. Our work has addressed some of the fundamental questions of PD such as “Where does the design practice end, and the practice of use begin?” The SER model provides a conceptual framework that demonstrates that informed participation can enrich our understanding and practice of participatory design to support all aspects of collaborative design.

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Personas, Participatory Design and Product Development: An Infrastructure for Engagement

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ABSTRACT
The design of commercial products that are intended to serve millions of people has been a challenge for collaborative approaches. The creation and use of fictional users, concrete representations commonly referred to as 'personas', is a relatively new interaction design technique. It is not without problems and can be used inappropriately, but based on experience and analysis it has extraordinary potential. Not only can it be a powerful tool for true participation in design, it also forces designers to consider social and political aspects of design that otherwise often go unexamined.

Keywords
Persona, design method, scenario, user-centered design

INTRODUCTION
Cooperative design techniques that can be effective in in-house or custom development contexts are less effective in commercial product or package software development. Traditional "user-centered" approaches have been improved upon in recent years but current practices tend to fall short in several respects: Designers and users are not truly engaged; social and political aspects are filtered out; and complexity and representativeness are difficult to identify and portray. In this paper we discuss *personas*, a technique that, if used in conjunction with other methods, can draw upon powerful psychological forces to restore these dimensions. The use of this method is rapidly spreading, including in our organization. In this paper we focus on presenting a theoretical case for the method, which may not at first glance appear to be participatory design, and then we discuss our own experience in utilizing this method.

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At the PDC '90 conference one of us presented a paper identifying "obstacles to participatory design in large product development organizations" [15, 16]. Designers of mass-market, commercial software often can't confidently identify specific users of their software. When attracting hundreds of thousands or millions of people is the goal, finding "representative" participants is a challenge. Organizational barriers are substantial: Designers must look outside their organization, but external parties have little incentive to participate over time, and development schedules rarely accommodate such involvement.

Although sustained user involvement seems desirable, its effect on commercial products is not clear. When an in-house or custom project does not include participatory design, the resulting problems can be obvious. But how would Microsoft Word, the Mac OS X or Lotus Notes differ had participatory design been extensively used?

PARTICIPATORY DESIGN IN PRODUCT DEVELOPMENT
Early Scandinavian efforts
Early in the participatory design movement, this was not an issue: Platform-independent software was not significant until the 1980s. Systems were built for one organization. In the mid-80s, recognizing the expense of developing for a single organization, participants in the UTOPIA project worked hard to involve a large segment of the newspaper industry. As the work progressed, the researchers on the team saw the potential for a general desktop publishing application, which did not exist at the time [12, 13].

This revealed the complexity of working closely with users on a possible new product. Ehn [13] describes a 'tradition/transcendence' tradeoff: A new product may be useful to new users, but not to the current users who have developed skills and conventions around existing tools and practices. The researchers saw a product potential, but worker participants desired a less generally useful system that was more closely synchronized with existing practices. The desktop publishing product was not designed.

In the early 1990s Scandinavian and North American researchers undertook efforts to marry collaborative practices to product development. At CHI '94 Morten Kyng's paper "Scandinavian design: Users in product development" described a traditional custom project to support the Great Links bridge construction that *also* included partners interested in using the research to design products [21]. The PDC '94 call for participation sought input from those who "investigate the incorporation of participatory design approaches in new areas such as product development."

Participatory methods from product developers

Product developers' efforts to adapt and extend elements of the participatory design approach include low-fidelity mock-ups and prototyping [14, 20, 24], increased engagement and communication with potential users [19, 25] and an emphasis on site visits and understanding the work context [2]. These methods focused on raising the level of "user participation" above that achieved in traditional laboratory studies.[1]

Although these methods can be useful, elements of the Scandinavian approach were lost in transfers to product development:

- Long-term engagement with particular participants, and the empathy, commitment and deep understanding that such engagement can bring;
- Attention to the sociopolitical and 'quality of life' issues that marked much of the early work, including values, fears, aspirations, and so forth.

We contend that the personas approach described below can help restore these elements. Because it supplements other approaches, nothing is lost beyond a manageable investment of time. First, though, we review two other important approaches from the mid- and late 1990s: ethnography and scenario-based design.

Ethnography and design

Conferences, journals, and books on Participatory Design, CSCW and HCI include numerous reports that focus on applying ethnographic approaches to product development [e.g., 3, 11]. Challenges in bridging ethnographic work and design include fitting the time course of such work to product design cycles and, of equal significance, communicating ethnographic analyses to designers and developers. Addressing this communication challenge is central to the shorter-term contextual design approach [2]. Another challenge is that ethnographies often identify disruptive effects that usually accompany the introduction of a new technology, the tradition/transcendence issue.

Scenarios without personas

Designers have long used scenarios to organize, justify, and communicate ideas. These often do not involve users [e.g., 5]. Recently, participatory design and human-computer interaction researchers have focused on the use of scenarios to engage users and development team members; see papers in the collections *Scenario-based design* [6] and *Scenario-based system development* [18].

We focus on scenarios because they share attributes with personas and at first glance can be more compelling. However, we will argue that scenarios are less effective when not built on personas.

Every reader is no doubt familiar with scenarios in some form, but as a framework consider Carroll's overview [7]. Scenarios are stories. They have a setting, agents or actors who have goals or objectives, and a plot or sequence of actions and events. His example:

> "An accountant wishes to open a folder on a system desktop in order to access a memo on budgets. However, the folder is covered up by a budget spreadsheet that the accountant wishes to refer to while reading the memo. The spreadsheet is so large that it nearly fills the display. The accountant pauses for several seconds, resizes the spreadsheet, moves it partially out of the display, opens the folder, opens the memo, resizes and repositions the memo and continues working."

Keep this example in mind.

Carroll notes that scenarios can help designers and analysts focus on assumptions about people and tasks, assumptions that are implicit in the software. Scenarios can encourage reflection during design, they are concrete yet flexible – easily revised, extended or fleshed out. They can be viewed from multiple perspectives, abstracted and categorized. Finally, Carroll notes that they promote a work orientation. Citing participatory design, he says "one can increase (their) effectiveness by couching them at an appropriate level and directly involving users in creating and using them."

The extensive literature on scenario-based design has little discussion of the "agents or actors." Little is said about defining an agent or using it appropriately; nothing is said about the values or aspirations of an agent/actor.

The participatory design community has used scenarios heavily to engage "future users." This includes acting out scenes of current or future envisioned work activities as mutual education about work practices, technology constraints, and new possibilities [19].

[1] Iterative design based on lab studies was itself considered participatory by some, e.g. [10].

Bødker [4] has extended scenario use to include more of a focus on reflection in action, describing three possible roles: to present and situate solutions, to illustrate alternative solutions, and to identify potential problems. Scenarios are clearly better for promoting reflection and discussion among team members and possible users than, say, formal specifications.

But scenarios come with substantial risks and problems. There is often little discussion of the data, if any, on which a scenario is constructed. A scenario constructed by actual workers might be trusted more, but memory is unreliable, people can be guided by a simplified conception of the routine or alternatively by extreme experiences.

Often scenarios are created to justify particular features or technologies. They may include unrealistic assumptions about work practice or technical feasibility. A quarter century of working with scenarios in design has left one of us feeling that scenarios are rarely useful because they are rarely empirically grounded. The most reassuring data would be ethnographic, followed by data drawn from contextual inquiry and analysis, obtained directly from participant-users, derived from demographic or market research, taken from observations of usability studies, or combinations of the above. More often, scenarios are used *in place of* real data on work practice. Scenarios are not a problem, but how they are used usually is.

Bødker [4] describes an innovative use of scenarios. Two detailed scenarios were constructed around the use of the same proposed technology: a cheery utopian vision and a nightmarish, dystopian vision. These succeeded in focusing discussion on how to design to avoid undesirable outcomes and enhance positive uses. This indirectly illustrates the weakness of a single scenario: It is not anchored to reality strongly enough to be more than an argument.

In a further insight, Bødker notes "It gives a better effect to create scenarios that are caricatures… it is much easier for users and whoever else is going to relate to the scenarios to assess things when they see full-blown consequences… Not that they 'believe' in the caricatures, indeed they do not, but it is much easier to use one's common sense judgment when confronted with a number of extremes than when judging based on some kind of 'middle ground.'"

Caricatures are engaging, but may not be necessary.

PERSONAS

Realistic scenarios appear to be a perfect tool for design: They depict the work practices one hopes to support. Their weakness is that they are not engaging. How well do you recall Carroll's accountant scenario, minutes after reading it? Reread it. Dull. Scenarios are often difficult to reconstruct and hard to extend with confidence. Engagement is important. That is why Bødker argued for caricatures, unrealistic extremes that are more engaging, more memorable.

Personas are a method for enhancing engagement *and* reality. We are finding them to be a powerful design tool in practice. Persona use does not require eliminating scenarios or any other method: It is a foundation on which to build scenarios and data collection. It is an infrastructure for engagement. It is a means for communicating data that is collected using other user research methods.

Personas are fictional people. They have names, likenesses, clothes, occupations, families, friends, pets, possessions, and so forth. They have age, gender, ethnicity, educational achievement, and socioeconomic status. They have life stories, goals and tasks. Scenarios can be constructed around personas, but the personas come first. They are not 'agents' or 'actors' in a script, they are people. Photographs of the personas (in our experience, 'amateur' volunteers were better than professional models) and their workplaces and homes are created and displayed in public places.

At first glance this could appear to be a step backward, away from the work context and the specific actions we want to support. (Of course, the specific actions are less important than the users' goals. The accountant did not want to open a folder to access a memo, s/he wanted to get a particular piece of information. Perhaps another solution would have been better.)

But to the extent that personas take a step back, it is to obtain a far more powerful level of identification and engagement that enable design, development, and testing to move forward more effectively.

Cooper [8] presents a case for the use of personas in design. The use of abstract user representations originated in the field of marketing [e.g., 23] but Cooper's use of personas, their goals, and activity scenarios is focused on design. Cooper's claims are based on anecdote and on appeals to reason, not on data. He does not describe in detail how personas are constructed. He exhibits a disdain for empiricism, including feedback on design possibilities. But our experience confirms the power of personas, and we and our colleagues have worked on ways to integrate personas with standard methodologies. Personas can be used badly. Our impression is that Cooper, a designer, has very good intuitions, but for most of us a more solid foundation will prove necessary.

Cooper marvels at the "surprising" power of personas, but does not endeavor to explain their power. Below we argue (with the benefit of hindsight, of course) that perhaps it should not have been so surprising. We then provide an overview of how we are employing personas and some tradeoffs and issues that remain to be resolved.

In parallel with Cooper, a few others have promoted the use of abstract representations of users to guide design: user profiles and scenarios derived from contextual inquiry [17, 29] and user classes fleshed out into "user archetypes" [22]. These practitioners, along with Cooper, are clear in positioning these representations as the starting point, around which scenarios are constructed.

The power of people

Early proponents of participatory design went to such lengths as playing football with workers who would be using (and helping design) software. Can we achieve comparable effects with fictional people, and if so, what is the cost and what are the benefits? What are the risks?

Soap operas, situation comedies, dramatic series. There is no question that fictional people can be extraordinarily engaging. Many viewers fully engage with characters in U.S. television programs such as *As the World Turns* and *ER*.

People in these extremely popular series for the most part resemble normal people. They may look better or be wittier on average, but their appeal is in part that they can be identified with (or against). They are often moderately complex—because we observe them over time, caricature is not essential.

Designers explored the use of shocking, caricatured personas in a short-term study and reported engagement and discussion [9]. But we have found, as did Cooper, that extreme characters and shock are not necessary. One factor is the duration of the exposure. A single film can benefit by having an extreme hero or villain, but this grows dull in a longer series. Characters in a series become more complex, more realistic. Similarly, once established, personas can be an ongoing presence, evolving to reflect data gathered from real people. That said, issues of stereotyping and casting against type in persona construction remain and are discussed in the final section.[2]

Method acting and the value of detail. When an actor prepares for a scene that takes place in, say, the living room of the house the character lives in, one exercise is to create a history for each prop, each piece of furniture. When was this table bought? Which meals are eaten on it? Where did this desk come from? What has the character put in the top drawer? The next drawer? How often is it used? And so on. None of these details are specified in the script. None directly impinge on the scene. But by specifying the detail, an actor may intuitively behave in a more natural, normal way. If one frequently uses a desk one might walk by it or glance at it in a particular way…

Some of this detail may be invented, but many actors spend days or weeks observing and talking with real people who resemble those to be portrayed. A character is fictional but the behavior is based on real data: precisely the goal with personas. If successful, the actor can accurately intuit a character's behavior in a new situation. A designer, developer, or tester can intuit the behavior in novel situations of the people on whom a persona is based.

Social reasoning and Theory of Mind.[3] Beyond engaging the attention of team members, a detailed persona enables them to draw on experience to fill in more aspects of behavior than are included in a scenario or specification. This utilizes a powerful human characteristic. From birth or soon thereafter, every day of our lives, we use partial knowledge to draw inferences, make predictions, and form expectations about the people around us. We are not always right, but we learn from experience. We continue to extrapolate. Personas evoke this universal capability and bring it into the design process. Faceless accountants lying inert on the page do not.

Thus, well crafted personas are generative. In the case of scenario creation, individuals across a product team can independently generate appropriate and complementary scenarios for seemingly disparate areas of a large, multifaceted product. As Cooper indicates, once a set of personas is constructed and provided with sets of goals, once team members have accepted and assimilated them, then meaningful scenarios can be constructed around them. We differ from Cooper in that we argue that the scenarios, personas, and product designs should evolve in response to ongoing observations of, and feedback from, the real people who inspired them.

Our experience with personas

One of the authors, along with many colleagues, has been actively using personas and refining techniques for using them for several years. We are preparing a paper detailing our method and experience. A few key points:

- Unlike Cooper, we feel strongly that persona use needs to be complemented with a strong, ongoing effort to obtain as much quantitative and qualitative information about users as possible, to improve the selection, enrichment,

[2] Lene Nielsen [26] describes the thinness or flatness of most scenario characters from the perspective of a writer.

[3] 'Theory of mind' was a term first used to describe primates' ability to predict the behavior of others by recognizing their mental state [28]. Subsequently it has become a field of research in child development [1]. 'Social intelligence' is a broader term, often used in describing animal, robot and software agent behavior.

and evolution of sets of personas. In our method, persona creation begins with quantitative market segmentation much like that discussed by Weinstein [30]. The highest priority segments get fleshed out with user research including field studies, focus groups, interviews and further market research.

- In a recent effort, persona creation involved a team of about 22 people over a period of roughly two months. Team members included product planners, usability engineers, interaction designers, market researchers, and technical writers. Other efforts have been less intensive, involving one or two people for shorter periods of time. These lighter efforts typically capitalized on existing user research and generated somewhat less detailed personas.
- We utilize a central "foundation" document for each persona as a storehouse for all information about that persona (data, key attributes, photos, reference materials, etc.). Figure 1 shows the table of contents for a foundation document. Note that the foundation document is not the primary means of communicating information about the persona to general team members (more on that below). Likewise, foundation documents do not contain all or even most of the feature scenarios (i.e., "walk-through" scenarios are located directly in the feature specifications). Instead, the foundation document contains goals, fears, and typical activities that serve to motivate and justify scenarios that appear in feature specifications.

Figure 1. Table of Contents for a Foundation Document

Overview – Patrick Blakeman (Small Business Owner)
Get to know Patrick, his business and family.

A Day in the Life
Follow Patrick through a typical day.

Work Activities
Look at Patrick's job description and role at work.

Household and Leisure Activities
Get information about what Patrick does when he's not at work.

Goals, Fears, and Aspirations
Understand the concerns Patrick has about his life, career, and business.

Computer Skills, Knowledge, and Abilities
Learn about Patrick's computer experience.

Market Size and Influence
Understand the impact people like Patrick have on our business.

Demographic Attributes
Read key demographic information about Patrick and his family.

Technology Attributes
Get a sense of what Patrick does with technology.

Technology Attitudes
Review Patrick's perspective on technology, past and future.

Communicating
Learn how Patrick keeps in touch with people.

International Considerations
Find out what Patrick is like outside the U.S.

Quotes
Hear what Patrick has to say.

References
See source materials for this document.

- Links between persona characteristics and the supporting data should be explicit and salient. If personas are not perceived as credible, they are not used. Our foundation documents contain copious footnotes, comments on specific data and links to research reports that support and explain the personas' characteristics. All persona illustrations and discussions link back to these foundation documents so that the team can always access the supporting documentation.
- "Grass roots" persona efforts, when a few people on a team decide to try the method, have typically had less impact than desired. Getting high-level management and key team members to buy into the use of personas is critical. On first encounter, the idea may seem too unscientific, "arty," to engineers and others. It can take a leap of faith for the first teams in an organization to try it. It is a major step to have team leaders say "We're all going to do it," provide people resources for creating and promoting the personas, and a budget for posters, T-shirts, and other materials to keep personas visible.
- Communicating about your personas should be multifaceted, multimodal, on-going, and progressively unfolding. While our foundation documents are available to anyone on the team who wishes to review them, they are not the primary means for delivering information about personas. Instead, we've created many variations of posters, flyers, handouts and giveaways (e.g., squeeze toys with persona images and information). Figure 2 shows the likeness of a poster comparing high level details of four personas. Additionally, we maintain a detailed web site that includes the foundation documents, supporting research, and a host of tools for using the personas (screening material for recruiting usability test participants, spreadsheet tools, comparison charts, posters and photos, etc.). We utilize email to routinely put small bits of persona information in front of the team (e.g., fact of the week, email from the personas – that's right, we've created email addresses for them). Very important are study participants recruited based on personas, with

findings grouped and reported by persona. Generally, we think of the persona effort as an on-going campaign.

Figure 2. A Persona Comparison Poster

- A successful persona campaign instructs a team in using the personas and provides tools to help. Cooper describes persona use mostly as a discussion tool. "Would Dave use this feature?" This is valuable, but we have generated additional activities and incorporated them into specific development processes, and created spreadsheet tools and document templates for clearer and consistent persona utilization.

As an example of how personas become concrete in the development process, Figure 3 shows an abstract version of a feature-persona weighted priority matrix that is used to help determine what features are built in the product development cycle. In this example, the scoring in the feature rows is as follows: -1 (the persona is confused, annoyed, or in some way harmed by the feature), 0 (the persona doesn't care about the feature one way or the other), +1 (the feature provides some value to the persona), +2 (the persona loves this feature or the feature does something wonderful for the persona even if they don't realize it). The sums are weighted according to the proportion of the market each represents. Features 2 and 4 should be high priority; 3 should probably be dropped.

	Persona 1	Persona 2	Persona 3	
Weight:	50	35	15	Weighted Sum
Feature 1	0	1	2	65
Feature 2	2	1	1	150
Feature 3	-1	1	0	-15
Feature 4	1	1	1	100
Etc.	-	-	-	-

Figure 3. A Feature-Persona Weighted Priority Matrix

Benefits of personas

- Personas create a strong focus on users and work contexts through the fictionalized setting. We've seen our personas go from scattered use (in early persona projects) to widespread adoption and understanding (in recent product cycles). Our personas are seen everywhere and used broadly (e.g., feature specifications, vision documents, storyboards, demo-ware, design discussions, bug bashes – even used by VP's in product strategy meetings arguing for user concerns). Not only have we seen our development teams engage personas, but correspondingly they have engaged in our other user-centered activities. In other words, our persona campaigns generated a momentum that increased general user focus and awareness. With our most recent persona effort, we've had partner teams, building related but different products, adapt our personas in an effort to enhance cross-team synergy and communication.
- Personas utilize our mind's powerful ability to extrapolate from partial knowledge of people to create coherent wholes and project them into new settings and situations. They encourage an end-to-end approach when considering large sets of features.
- The act of creating personas makes explicit our assumptions about the target audience. Once created, they help to keep the assumptions and decision-making criteria explicit. Why are we building this feature? Why are we building it like this? Without personas, development teams routinely make decisions about features and implementation without recognizing or communicating their underlying assumptions about who will use the product and how it will be used.
- Personas are a medium for communication; a conduit for information about users and work settings derived from ethnographies, market research, usability studies, interviews, observations, and so on. Personas utilize the power of narrative and storytelling to enhance attention, memory, and organization of detailed user data. How many of your team members actually read through market research and usability reports? How much of it do they remember? Once a set of personas is familiar to a team, a

new finding can be instantly communicated: "Patrick cannot use the search tool on your web page" has an immediacy that "a subset of participants in the usability study had problems with the search tool" doesn't, especially for team members who now see Patrick as a person as real as, say, Mark Green on "*ER*."[4]

- Personas focus attention on a specific target audience. The method helps establish who is and consequently who is not being designed for. Personas explicitly do not cover every conceivable user. They also help focus sequentially on different kinds of users. For example, a quality assurance engineer can one day test a product focusing on Sondra scenarios, another day focusing on Ichiro scenarios.

  In our experience, this works for testers and other product team members in "bug bashes." An experienced tester reported feeling that he was identifying "the right kind" of problems in drawing on knowledge of a persona in guiding his test scripts and activities.

  Compare this to an observation from a study of interface development:

  > Some people realized that tests conducted by Quality Control to ensure that the product matches specification were not sufficient. One manager noted, 'I would say that testing should be done by a group outside Development. 'Cause Development knows how the code works, and even though you don't want it to, your subconscious makes you test the way you know it works… See, those people in the Quality Control group have nothing to do with customers. They're not users.'
  >
  > In fact, two members of Field Support were reported to have found more bugs than the Quality Control group in the latest release, and they had accomplished this by working with the product as they imagined that users would. Testing by Field Support was an innovative experiment, however, and not part of the accepted development process.
  >
  > 'The Quality Control group has a lot of systematic testing, and you need some of that, but at the same time, you need somebody who is essentially a customer. It is as if you had a customer in house who uses it the way a customer would every day, and is particularly tough on it and shakes all these things out. That's what these two guys did, and it was just invaluable.' (Poltrock and Grudin [27], page 64.)

  The two Field Support engineers were able to "test as a user" because of their extensive experience with customers. That persona use results in similar positive reports is encouraging.

Risks of personas

Getting the right persona or set of personas is a challenge. Cooper argues that designing for *any* one external person is better than trying to design vaguely for everyone or specifically for oneself. This may be true, and it does feel as though settling on a small set of personas provides some insurance, but it also seems clear that personas should be developed for a particular effort. In making choices it becomes clear that the choices have consequences. For example, they will be used to guide participant selection for future studies and could be used to filter out data from sources not matching one of the persona profiles.

Related to this is the temptation toward persona reuse. With an investment in developing personas and acquainting people with them, it may be difficult to avoid over-extending their use when it is time to disband one cast of characters and recruit another one. It can be good or bad when our partner teams adopt or adapt our personas. Different teams and products have different goals, so the personas are stretched a bit. So far, the stretching has been modest and closely tied to data (because our target customers do indeed overlap), but it is a concern.

In addition, marketing and product development have different needs that require different persona attributes, and sometime different target audiences. Marketing is generally interested in buyer behavior and customers; product development is interested in end-users. We've had some success in collaborating here, but there are rough edges.

Finally, we have seen a certain level of 'persona mania' within our organization and others. There can be a temptation to overuse personas. At worst, they could be used to replace other user-centered methods, ongoing data collection, and product evaluation. Personas are not a panacea. They should augment and enhance – augment existing design processes and enhance user focus.

Personas and sociopolitical awareness

We conclude by addressing another key element of the early participatory design movement that has been filtered out of most subsequent efforts and techniques, that of social and political consciousness. Early participatory design efforts were explicitly focused on improving the quality of working life for those workers most at risk of unrewarding consequences of information technology [12].

[4] Or your favorite television or movie character. Team members conversing with other people often refer to personas without realizing that the others don't know who they are. One person remarked "Hillel wants Irene dead." Hillel, a senior manager, was observed tearing down a poster about Irene, a persona he did not want his group focusing on.

The tool of persona use forces one to decide precisely whom one is designing to support. Each persona has a gender, age, race, ethnic, family or cohabitation arrangement, and socio-economic background. This forces existing assumptions about users to the surface and provides an effective avenue for changing or countering them. One could populate an entire persona set with middle-aged white males, but it would be obvious that this is a mistake.

Cooper writes that "all things being equal, I will use people of different races, genders, nationalities, and colors." He quickly adds that "political correctness" is not his goal, but realism. He uses stereotypes if he feels it will provide more credence; he avoids casting strongly against expectations if he feels it will undermine credibility.

Participatory design researchers and practitioners will appreciate the subtleties and the potential of this dance.

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Personas, Participatory Design and Product Development: An Infrastructure for Engagement

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ABSTRACT
The design of commercial products that are intended to serve millions of people has been a challenge for collaborative approaches. The creation and use of fictional users, concrete representations commonly referred to as 'personas', is a relatively new interaction design technique. It is not without problems and can be used inappropriately, but based on experience and analysis it has extraordinary potential. Not only can it be a powerful tool for true participation in design, it also forces designers to consider social and political aspects of design that otherwise often go unexamined.

Keywords
Persona, design method, scenario, user-centered design

INTRODUCTION
Cooperative design techniques that can be effective in in-house or custom development contexts are less effective in commercial product or package software development. Traditional "user-centered" approaches have been improved upon in recent years but current practices tend to fall short in several respects: Designers and users are not truly engaged; social and political aspects are filtered out; and complexity and representativeness are difficult to identify and portray. In this paper we discuss *personas*, a technique that, if used in conjunction with other methods, can draw upon powerful psychological forces to restore these dimensions. The use of this method is rapidly spreading, including in our organization. In this paper we focus on presenting a theoretical case for the method, which may not at first glance appear to be participatory design, and then we discuss our own experience in utilizing this method.

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At the PDC '90 conference one of us presented a paper identifying "obstacles to participatory design in large product development organizations" [15, 16]. Designers of mass-market, commercial software often can't confidently identify specific users of their software. When attracting hundreds of thousands or millions of people is the goal, finding "representative" participants is a challenge. Organizational barriers are substantial: Designers must look outside their organization, but external parties have little incentive to participate over time, and development schedules rarely accommodate such involvement.

Although sustained user involvement seems desirable, its effect on commercial products is not clear. When an in-house or custom project does not include participatory design, the resulting problems can be obvious. But how would Microsoft Word, the Mac OS X or Lotus Notes differ had participatory design been extensively used?

PARTICIPATORY DESIGN IN PRODUCT DEVELOPMENT
Early Scandinavian efforts
Early in the participatory design movement, this was not an issue: Platform-independent software was not significant until the 1980s. Systems were built for one organization. In the mid-80s, recognizing the expense of developing for a single organization, participants in the UTOPIA project worked hard to involve a large segment of the newspaper industry. As the work progressed, the researchers on the team saw the potential for a general desktop publishing application, which did not exist at the time [12, 13].

This revealed the complexity of working closely with users on a possible new product. Ehn [13] describes a 'tradition/transcendence' tradeoff: A new product may be useful to new users, but not to the current users who have developed skills and conventions around existing tools and practices. The researchers saw a product potential, but worker participants desired a less generally useful system that was more closely synchronized with existing practices. The desktop publishing product was not designed.

In the early 1990s Scandinavian and North American researchers undertook efforts to marry collaborative practices to product development. At CHI ’94 Morten Kyng’s paper “Scandinavian design: Users in product development” described a traditional custom project to support the Great Links bridge construction that *also* included partners interested in using the research to design products [21]. The PDC ’94 call for participation sought input from those who “investigate the incorporation of participatory design approaches in new areas such as product development.”

Participatory methods from product developers

Product developers’ efforts to adapt and extend elements of the participatory design approach include low-fidelity mock-ups and prototyping [14, 20, 24], increased engagement and communication with potential users [19, 25] and an emphasis on site visits and understanding the work context [2]. These methods focused on raising the level of “user participation” above that achieved in traditional laboratory studies.[1]

Although these methods can be useful, elements of the Scandinavian approach were lost in transfers to product development:

- Long-term engagement with particular participants, and the empathy, commitment and deep understanding that such engagement can bring;
- Attention to the sociopolitical and ‘quality of life’ issues that marked much of the early work, including values, fears, aspirations, and so forth.

We contend that the personas approach described below can help restore these elements. Because it supplements other approaches, nothing is lost beyond a manageable investment of time. First, though, we review two other important approaches from the mid- and late 1990s: ethnography and scenario-based design.

Ethnography and design

Conferences, journals, and books on Participatory Design, CSCW and HCI include numerous reports that focus on applying ethnographic approaches to product development [e.g., 3, 11]. Challenges in bridging ethnographic work and design include fitting the time course of such work to product design cycles and, of equal significance, communicating ethnographic analyses to designers and developers. Addressing this communication challenge is central to the shorter-term contextual design approach [2]. Another challenge is that ethnographies often identify disruptive effects that usually accompany the introduction of a new technology, the tradition/transcendence issue.

[1] Iterative design based on lab studies was itself considered participatory by some, e.g. [10].

Scenarios without personas

Designers have long used scenarios to organize, justify, and communicate ideas. These often do not involve users [e.g., 5]. Recently, participatory design and human-computer interaction researchers have focused on the use of scenarios to engage users and development team members; see papers in the collections *Scenario-based design* [6] and *Scenario-based system development* [18].

We focus on scenarios because they share attributes with personas and at first glance can be more compelling. However, we will argue that scenarios are less effective when not built on personas.

Every reader is no doubt familiar with scenarios in some form, but as a framework consider Carroll’s overview [7]. Scenarios are stories. They have a setting, agents or actors who have goals or objectives, and a plot or sequence of actions and events. His example:

> “An accountant wishes to open a folder on a system desktop in order to access a memo on budgets. However, the folder is covered up by a budget spreadsheet that the accountant wishes to refer to while reading the memo. The spreadsheet is so large that it nearly fills the display. The accountant pauses for several seconds, resizes the spreadsheet, moves it partially out of the display, opens the folder, opens the memo, resizes and repositions the memo and continues working.”

Keep this example in mind.

Carroll notes that scenarios can help designers and analysts focus on assumptions about people and tasks, assumptions that are implicit in the software. Scenarios can encourage reflection during design, they are concrete yet flexible – easily revised, extended or fleshed out. They can be viewed from multiple perspectives, abstracted and categorized. Finally, Carroll notes that they promote a work orientation. Citing participatory design, he says “one can increase (their) effectiveness by couching them at an appropriate level and directly involving users in creating and using them.”

The extensive literature on scenario-based design has little discussion of the “agents or actors.” Little is said about defining an agent or using it appropriately; nothing is said about the values or aspirations of an agent/actor.

The participatory design community has used scenarios heavily to engage “future users.” This includes acting out scenes of current or future envisioned work activities as mutual education about work practices, technology constraints, and new possibilities [19].

Bødker [4] has extended scenario use to include more of a focus on reflection in action, describing three possible roles: to present and situate solutions, to illustrate alternative solutions, and to identify potential problems. Scenarios are clearly better for promoting reflection and discussion among team members and possible users than, say, formal specifications.

But scenarios come with substantial risks and problems. There is often little discussion of the data, if any, on which a scenario is constructed. A scenario constructed by actual workers might be trusted more, but memory is unreliable, people can be guided by a simplified conception of the routine or alternatively by extreme experiences.

Often scenarios are created to justify particular features or technologies. They may include unrealistic assumptions about work practice or technical feasibility. A quarter century of working with scenarios in design has left one of us feeling that scenarios are rarely useful because they are rarely empirically grounded. The most reassuring data would be ethnographic, followed by data drawn from contextual inquiry and analysis, obtained directly from participant-users, derived from demographic or market research, taken from observations of usability studies, or combinations of the above. More often, scenarios are used *in place of* real data on work practice. Scenarios are not a problem, but how they are used usually is.

Bødker [4] describes an innovative use of scenarios. Two detailed scenarios were constructed around the use of the same proposed technology: a cheery utopian vision and a nightmarish, dystopian vision. These succeeded in focusing discussion on how to design to avoid undesirable outcomes and enhance positive uses. This indirectly illustrates the weakness of a single scenario: It is not anchored to reality strongly enough to be more than an argument.

In a further insight, Bødker notes "It gives a better effect to create scenarios that are caricatures… it is much easier for users and whoever else is going to relate to the scenarios to assess things when they see full-blown consequences… Not that they 'believe' in the caricatures, indeed they do not, but it is much easier to use one's common sense judgment when confronted with a number of extremes than when judging based on some kind of 'middle ground.'"

Caricatures are engaging, but may not be necessary.

PERSONAS

Realistic scenarios appear to be a perfect tool for design: They depict the work practices one hopes to support. Their weakness is that they are not engaging. How well do you recall Carroll's accountant scenario, minutes after reading it? Reread it. Dull. Scenarios are often difficult to reconstruct and hard to extend with confidence. Engagement is important. That is why Bødker argued for caricatures, unrealistic extremes that are more engaging, more memorable.

Personas are a method for enhancing engagement *and* reality. We are finding them to be a powerful design tool in practice. Persona use does not require eliminating scenarios or any other method: It is a foundation on which to build scenarios and data collection. It is an infrastructure for engagement. It is a means for communicating data that is collected using other user research methods.

Personas are fictional people. They have names, likenesses, clothes, occupations, families, friends, pets, possessions, and so forth. They have age, gender, ethnicity, educational achievement, and socioeconomic status. They have life stories, goals and tasks. Scenarios can be constructed around personas, but the personas come first. They are not 'agents' or 'actors' in a script, they are people. Photographs of the personas (in our experience, 'amateur' volunteers were better than professional models) and their workplaces and homes are created and displayed in public places.

At first glance this could appear to be a step backward, away from the work context and the specific actions we want to support. (Of course, the specific actions are less important than the users' goals. The accountant did not want to open a folder to access a memo, s/he wanted to get a particular piece of information. Perhaps another solution would have been better.)

But to the extent that personas take a step back, it is to obtain a far more powerful level of identification and engagement that enable design, development, and testing to move forward more effectively.

Cooper [8] presents a case for the use of personas in design. The use of abstract user representations originated in the field of marketing [e.g., 23] but Cooper's use of personas, their goals, and activity scenarios is focused on design. Cooper's claims are based on anecdote and on appeals to reason, not on data. He does not describe in detail how personas are constructed. He exhibits a disdain for empiricism, including feedback on design possibilities. But our experience confirms the power of personas, and we and our colleagues have worked on ways to integrate personas with standard methodologies. Personas can be used badly. Our impression is that Cooper, a designer, has very good intuitions, but for most of us a more solid foundation will prove necessary.

Cooper marvels at the "surprising" power of personas, but does not endeavor to explain their power. Below we argue (with the benefit of hindsight, of course) that perhaps it should not have been so surprising. We then provide an overview of how we are employing personas and some tradeoffs and issues that remain to be resolved.

In parallel with Cooper, a few others have promoted the use of abstract representations of users to guide design: user profiles and scenarios derived from contextual inquiry [17, 29] and user classes fleshed out into "user archetypes" [22]. These practitioners, along with Cooper, are clear in positioning these representations as the starting point, around which scenarios are constructed.

The power of people

Early proponents of participatory design went to such lengths as playing football with workers who would be using (and helping design) software. Can we achieve comparable effects with fictional people, and if so, what is the cost and what are the benefits? What are the risks?

Soap operas, situation comedies, dramatic series. There is no question that fictional people can be extraordinarily engaging. Many viewers fully engage with characters in U.S. television programs such as *As the World Turns* and *ER*.

People in these extremely popular series for the most part resemble normal people. They may look better or be wittier on average, but their appeal is in part that they can be identified with (or against). They are often moderately complex—because we observe them over time, caricature is not essential.

Designers explored the use of shocking, caricatured personas in a short-term study and reported engagement and discussion [9]. But we have found, as did Cooper, that extreme characters and shock are not necessary. One factor is the duration of the exposure. A single film can benefit by having an extreme hero or villain, but this grows dull in a longer series. Characters in a series become more complex, more realistic. Similarly, once established, personas can be an ongoing presence, evolving to reflect data gathered from real people. That said, issues of stereotyping and casting against type in persona construction remain and are discussed in the final section.[2]

Method acting and the value of detail. When an actor prepares for a scene that takes place in, say, the living room of the house the character lives in, one exercise is to create a history for each prop, each piece of furniture. When was this table bought? Which meals are eaten on it? Where did this desk come from? What has the character put in the top drawer? The next drawer? How often is it used? And so on. None of these details are specified in the script. None directly impinge on the scene. But by specifying the detail, an actor may intuitively behave in a more natural, normal way. If one frequently uses a desk one might walk by it or glance at it in a particular way…

Some of this detail may be invented, but many actors spend days or weeks observing and talking with real people who resemble those to be portrayed. A character is fictional but the behavior is based on real data: precisely the goal with personas. If successful, the actor can accurately intuit a character's behavior in a new situation. A designer, developer, or tester can intuit the behavior in novel situations of the people on whom a persona is based.

Social reasoning and Theory of Mind.[3] Beyond engaging the attention of team members, a detailed persona enables them to draw on experience to fill in more aspects of behavior than are included in a scenario or specification. This utilizes a powerful human characteristic. From birth or soon thereafter, every day of our lives, we use partial knowledge to draw inferences, make predictions, and form expectations about the people around us. We are not always right, but we learn from experience. We continue to extrapolate. Personas evoke this universal capability and bring it into the design process. Faceless accountants lying inert on the page do not.

Thus, well crafted personas are generative. In the case of scenario creation, individuals across a product team can independently generate appropriate and complementary scenarios for seemingly disparate areas of a large, multifaceted product. As Cooper indicates, once a set of personas is constructed and provided with sets of goals, once team members have accepted and assimilated them, then meaningful scenarios can be constructed around them. We differ from Cooper in that we argue that the scenarios, personas, and product designs should evolve in response to ongoing observations of, and feedback from, the real people who inspired them.

Our experience with personas

One of the authors, along with many colleagues, has been actively using personas and refining techniques for using them for several years. We are preparing a paper detailing our method and experience. A few key points:

- Unlike Cooper, we feel strongly that persona use needs to be complemented with a strong, ongoing effort to obtain as much quantitative and qualitative information about users as possible, to improve the selection, enrichment,

[2] Lene Nielsen [26] describes the thinness or flatness of most scenario characters from the perspective of a writer.

[3] 'Theory of mind' was a term first used to describe primates' ability to predict the behavior of others by recognizing their mental state [28]. Subsequently it has become a field of research in child development [1]. 'Social intelligence' is a broader term, often used in describing animal, robot and software agent behavior.

and evolution of sets of personas. In our method, persona creation begins with quantitative market segmentation much like that discussed by Weinstein [30]. The highest priority segments get fleshed out with user research including field studies, focus groups, interviews and further market research.

- In a recent effort, persona creation involved a team of about 22 people over a period of roughly two months. Team members included product planners, usability engineers, interaction designers, market researchers, and technical writers. Other efforts have been less intensive, involving one or two people for shorter periods of time. These lighter efforts typically capitalized on existing user research and generated somewhat less detailed personas.
- We utilize a central "foundation" document for each persona as a storehouse for all information about that persona (data, key attributes, photos, reference materials, etc.). Figure 1 shows the table of contents for a foundation document. Note that the foundation document is not the primary means of communicating information about the persona to general team members (more on that below). Likewise, foundation documents do not contain all or even most of the feature scenarios (i.e., "walk-through" scenarios are located directly in the feature specifications). Instead, the foundation document contains goals, fears, and typical activities that serve to motivate and justify scenarios that appear in feature specifications.

Figure 1. Table of Contents for a Foundation Document

Overview – Patrick Blakeman (Small Business Owner)
Get to know Patrick, his business and family.

A Day in the Life
Follow Patrick through a typical day.

Work Activities
Look at Patrick's job description and role at work.

Household and Leisure Activities
Get information about what Patrick does when he's not at work.

Goals, Fears, and Aspirations
Understand the concerns Patrick has about his life, career, and business.

Computer Skills, Knowledge, and Abilities
Learn about Patrick's computer experience.

Market Size and Influence
Understand the impact people like Patrick have on our business.

Demographic Attributes
Read key demographic information about Patrick and his family.

Technology Attributes
Get a sense of what Patrick does with technology.

Technology Attitudes
Review Patrick's perspective on technology, past and future.

Communicating
Learn how Patrick keeps in touch with people.

International Considerations
Find out what Patrick is like outside the U.S.

Quotes
Hear what Patrick has to say.

References
See source materials for this document.

- Links between persona characteristics and the supporting data should be explicit and salient. If personas are not perceived as credible, they are not used. Our foundation documents contain copious footnotes, comments on specific data and links to research reports that support and explain the personas' characteristics. All persona illustrations and discussions link back to these foundation documents so that the team can always access the supporting documentation.
- "Grass roots" persona efforts, when a few people on a team decide to try the method, have typically had less impact than desired. Getting high-level management and key team members to buy into the use of personas is critical. On first encounter, the idea may seem too unscientific, "arty," to engineers and others. It can take a leap of faith for the first teams in an organization to try it. It is a major step to have team leaders say "We're all going to do it," provide people resources for creating and promoting the personas, and a budget for posters, T-shirts, and other materials to keep personas visible.
- Communicating about your personas should be multifaceted, multimodal, on-going, and progressively unfolding. While our foundation documents are available to anyone on the team who wishes to review them, they are not the primary means for delivering information about personas. Instead, we've created many variations of posters, flyers, handouts and giveaways (e.g., squeeze toys with persona images and information). Figure 2 shows the likeness of a poster comparing high level details of four personas. Additionally, we maintain a detailed web site that includes the foundation documents, supporting research, and a host of tools for using the personas (screening material for recruiting usability test participants, spreadsheet tools, comparison charts, posters and photos, etc.). We utilize email to routinely put small bits of persona information in front of the team (e.g., fact of the week, email from the personas – that's right, we've created email addresses for them). Very important are study participants recruited based on personas, with

findings grouped and reported by persona. Generally, we think of the persona effort as an on-going campaign.

Figure 2. A Persona Comparison Poster

- A successful persona campaign instructs a team in using the personas and provides tools to help. Cooper describes persona use mostly as a discussion tool. "Would Dave use this feature?" This is valuable, but we have generated additional activities and incorporated them into specific development processes, and created spreadsheet tools and document templates for clearer and consistent persona utilization.

  As an example of how personas become concrete in the development process, Figure 3 shows an abstract version of a feature-persona weighted priority matrix that is used to help determine what features are built in the product development cycle. In this example, the scoring in the feature rows is as follows: -1 (the persona is confused, annoyed, or in some way harmed by the feature), 0 (the persona doesn't care about the feature one way or the other), +1 (the feature provides some value to the persona), +2 (the persona loves this feature or the feature does something wonderful for the persona even if they don't realize it). The sums are weighted according to the proportion of the market each represents. Features 2 and 4 should be high priority; 3 should probably be dropped.

	Persona 1	Persona 2	Persona 3	
Weight:	50	35	15	Weighted Sum
Feature 1	0	1	2	65
Feature 2	2	1	1	150
Feature 3	-1	1	0	-15
Feature 4	1	1	1	100
Etc.	-	-	-	-

Figure 3. A Feature-Persona Weighted Priority Matrix

Benefits of personas

- Personas create a strong focus on users and work contexts through the fictionalized setting. We've seen our personas go from scattered use (in early persona projects) to widespread adoption and understanding (in recent product cycles). Our personas are seen everywhere and used broadly (e.g., feature specifications, vision documents, storyboards, demo-ware, design discussions, bug bashes – even used by VP's in product strategy meetings arguing for user concerns). Not only have we seen our development teams engage personas, but correspondingly they have engaged in our other user-centered activities. In other words, our persona campaigns generated a momentum that increased general user focus and awareness. With our most recent persona effort, we've had partner teams, building related but different products, adapt our personas in an effort to enhance cross-team synergy and communication.
- Personas utilize our mind's powerful ability to extrapolate from partial knowledge of people to create coherent wholes and project them into new settings and situations. They encourage an end-to-end approach when considering large sets of features.
- The act of creating personas makes explicit our assumptions about the target audience. Once created, they help to keep the assumptions and decision-making criteria explicit. Why are we building this feature? Why are we building it like this? Without personas, development teams routinely make decisions about features and implementation without recognizing or communicating their underlying assumptions about who will use the product and how it will be used.
- Personas are a medium for communication; a conduit for information about users and work settings derived from ethnographies, market research, usability studies, interviews, observations, and so on. Personas utilize the power of narrative and storytelling to enhance attention, memory, and organization of detailed user data. How many of your team members actually read through market research and usability reports? How much of it do they remember? Once a set of personas is familiar to a team, a

new finding can be instantly communicated: "Patrick cannot use the search tool on your web page" has an immediacy that "a subset of participants in the usability study had problems with the search tool" doesn't, especially for team members who now see Patrick as a person as real as, say, Mark Green on "*ER*."[4]

- Personas focus attention on a specific target audience. The method helps establish who is and consequently who is not being designed for. Personas explicitly do not cover every conceivable user. They also help focus sequentially on different kinds of users. For example, a quality assurance engineer can one day test a product focusing on Sondra scenarios, another day focusing on Ichiro scenarios.

  In our experience, this works for testers and other product team members in "bug bashes." An experienced tester reported feeling that he was identifying "the right kind" of problems in drawing on knowledge of a persona in guiding his test scripts and activities.

  Compare this to an observation from a study of interface development:

> Some people realized that tests conducted by Quality Control to ensure that the product matches specification were not sufficient. One manager noted, 'I would say that testing should be done by a group outside Development. 'Cause Development knows how the code works, and even though you don't want it to, your subconscious makes you test the way you know it works… See, those people in the Quality Control group have nothing to do with customers. They're not users.'
>
> In fact, two members of Field Support were reported to have found more bugs than the Quality Control group in the latest release, and they had accomplished this by working with the product as they imagined that users would. Testing by Field Support was an innovative experiment, however, and not part of the accepted development process.
>
> 'The Quality Control group has a lot of systematic testing, and you need some of that, but at the same time, you need somebody who is essentially a customer. It is as if you had a customer in house who uses it the way a customer would every day, and is particularly tough on it and shakes all these things out. That's what these two guys did, and it was just invaluable.' (Poltrock and Grudin [27], page 64.)

  The two Field Support engineers were able to "test as a user" because of their extensive experience with customers. That persona use results in similar positive reports is encouraging.

Risks of personas

Getting the right persona or set of personas is a challenge. Cooper argues that designing for *any* one external person is better than trying to design vaguely for everyone or specifically for oneself. This may be true, and it does feel as though settling on a small set of personas provides some insurance, but it also seems clear that personas should be developed for a particular effort. In making choices it becomes clear that the choices have consequences. For example, they will be used to guide participant selection for future studies and could be used to filter out data from sources not matching one of the persona profiles.

Related to this is the temptation toward persona reuse. With an investment in developing personas and acquainting people with them, it may be difficult to avoid over-extending their use when it is time to disband one cast of characters and recruit another one. It can be good or bad when our partner teams adopt or adapt our personas. Different teams and products have different goals, so the personas are stretched a bit. So far, the stretching has been modest and closely tied to data (because our target customers do indeed overlap), but it is a concern.

In addition, marketing and product development have different needs that require different persona attributes, and sometime different target audiences. Marketing is generally interested in buyer behavior and customers; product development is interested in end-users. We've had some success in collaborating here, but there are rough edges.

Finally, we have seen a certain level of 'persona mania' within our organization and others. There can be a temptation to overuse personas. At worst, they could be used to replace other user-centered methods, ongoing data collection, and product evaluation. Personas are not a panacea. They should augment and enhance – augment existing design processes and enhance user focus.

Personas and sociopolitical awareness

We conclude by addressing another key element of the early participatory design movement that has been filtered out of most subsequent efforts and techniques, that of social and political consciousness. Early participatory design efforts were explicitly focused on improving the quality of working life for those workers most at risk of unrewarding consequences of information technology [12].

[4] Or your favorite television or movie character. Team members conversing with other people often refer to personas without realizing that the others don't know who they are. One person remarked "Hillel wants Irene dead." Hillel, a senior manager, was observed tearing down a poster about Irene, a persona he did not want his group focusing on.

The tool of persona use forces one to decide precisely whom one is designing to support. Each persona has a gender, age, race, ethnic, family or cohabitation arrangement, and socio-economic background. This forces existing assumptions about users to the surface and provides an effective avenue for changing or countering them. One could populate an entire persona set with middle-aged white males, but it would be obvious that this is a mistake.

Cooper writes that "all things being equal, I will use people of different races, genders, nationalities, and colors." He quickly adds that "political correctness" is not his goal, but realism. He uses stereotypes if he feels it will provide more credence; he avoids casting strongly against expectations if he feels it will undermine credibility.

Participatory design researchers and practitioners will appreciate the subtleties and the potential of this dance.

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Partner Engaged Design
New Challenges For Workplace Design

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ABSTRACT
The spatial organization of the workplace affects the work going on there. The technology used, changes the work practice. This paper describes a design process where different aspects of workplace design for project-based office work have been combined into one multi-stakeholder project, integrating the spatial aspects, the furniture, the information technology, and the IT-services that are connected to work.

To have several different partners with different interests and competencies collaborating in a future oriented design process puts certain demands on the setup of the process and the tools being used. Taking a starting point in existing work practice, we have driven this project with techniques most often used for user-involvement. Scenario building played a crucial role in tying the process together. The concrete result is a completed concept proposal for an actual "office of the future" layout, which integrates advanced information technology and service solutions. The case shows that it is possible to reach innovative consensus-anchored results with the described design method.

Keywords
Workplace design, Work practice based design, Collaborative inquiry and design, Architectural design,

INTRODUCTION
The process of designing new modern workplaces is more challenging than ever, and new ways of working are needed in order to overcome these challenges (Cash 2001). The challenges are rooted in the fact that today's companies have to operate in societies in rapid and continuous change where the introduction of new, better and faster technologies together with the increasing international competition calls for business concepts, employees and workplaces that can react fast on these changes.

As technology becomes an increasingly important part of the activities carried out at work innovative workplace design is no longer just a question of architecture in the sense of spatial arrangement and furniture. Instead of a linear and successive design process we argue for a process that simultaneously take into account the physical space, the furniture, the technological support and the activities that are going to take place within the workplace. Such a design process is difficult to carry out, as it requires that people who have competencies within various fields work together on the same design task.

Within an action research format we have explored the idea of a "Design Lab" where people with various competencies regularly meet and inquire into workplace design issues, develop workplace concepts and explore representations of these as-if workplaces in a collaborative setting. This paper reports from a project where we, together with four different industrial partners and a group of office workers collaboratively developed a concept for an "Experiment Office", a working prototype for an "office of the future".

BACKGROUND
In the seventies the issue of participatory design was focused on democracy. This was in correspondence with the development within the rest of the society, and the rise of an engagement and awareness of good work environments. The role played by the workplace designer was to let the employees feel that their input had been taken care of and at the same time represent the client so that she/he still as in control of the overall process. Later architects became increasingly aware of the relevance of involving employee knowledge and competences. This resulted in more influence and valuable knowledge to the design process. The designer's commission now was to interview or collect data from the employees as they where regarded as the main source of information about their own needs. These participatory design methods made it possible

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to better examine and fulfill the employee's explicit requirements about their work environment. The employees participated in order to communicate information and demands about their outspoken needs. The designers main concern was to ask what they wanted and from this information design proposals were made. (Granath 1996) Mental images of one's workplace and how to design it seems however to have a power to persist even when the foundations for their existence have changed. The result thus often tends to be a confirmation of the users preconception of what their work environments used to look like As a consequence one often sees that, despite the often dramatic changes in work practice imposed by among other things the new information and communication technologies many organizations and corporations choose, actively or passively, to work in traditional and rather stiff spatial structures.

THE COLLABORATIVE DESIGN LAB

New ways to carry out the process of workplace design, especially in the early conceptual phase are required (Duffy 2001). The concept of collective or collaborate design has been introduced in several fields (Ehn 1988, Granath 1996, Horgen et al 1999). Our goal is to develop a design process that integrates today's complex and fast changing conditions and the multi-disciplinary partners who are engaged in the work of shaping the modern workplace. The workplace of tomorrow will more and more be developed together with the users who are in the center of change, and who are the holders of intimate knowledge about new ways of working. This demands a design process that can create a "Design Lab" which integrates users, external partners and designers, and that offers new tools to support collaborative inquiry and design.

Partner engaged collaborative design

In a partner engaged collaborative design process different stakeholders and users are involved actively in the design work. With this concept we are talking about three aspects of the design process. We put emphasize on *who* is attending, on the *role* of acting (engagement or just participation) and on *how* it is carried through. In our concept of the Design Lab the design process is individually tailored for each project and is based on a series of structured design workshops with focus on collaborative inquiry and design (Brandt, 2001). The workshop participants use various tools and design artifacts, such as video cards, boardgames, scenarios and interactive digital VR visualizations, that have been developed with the purpose of promoting creativity and facilitating common understanding of the design problem.

A partner engaged collaborative design process develops new concepts through joint interaction and dialogue. It includes active collaboration between users, different stakeholders and designers. It builds on collaborative observation, inquiry, design and evaluation as ways to understand work, and advanced visualizations in conceptual design and scenario building. The partners play an active role in exploring existing workplaces and the making of new work environments.

Opening up the design process by involving a diverse group of stakeholders complicates the design work. Understanding each other is often difficult when the participants have various competencies and perhaps various professional languages. Differences in interests and responsibilities can give rise to conflicts. Furthermore, if people are involved at different times and with varying intensity, an important issue is how to continuously build on previous work and insights gained. Thus in order to succeed with a design process involving many stakeholders with various competencies, interests, and responsibilities, the design process itself has to be innovatively re-thought.

Shifting focus from design tasks to design events

Both within workplace design and engineering design authors have stressed the collaborative aspects of design work (Horgen et al, 1999, Bucciarelli, 1994). When describing the social process of design work Bucciarelli introduces the term "object worlds". Object worlds describe the physical space including the artifacts within which the design work takes place. Object worlds also describe the mental "images" that the designers create in their minds as well as the actions they perform as part of their work. According to Bucciaralli an important part of the design process involves communication, negotiation and entering compromises. He argues that even though compromises are made each person still has her own perception of the design task and that this is rooted in her special expertise and responsibilities. Blessing (1994) has thoroughly examined the literature published on the product development process during the last century. Blessing finds that there is a poor match between the prescriptive models of the development process and descriptive studies of design work in practice. She identifies two main sources of these discrepancies. First she finds that prescriptive models are generally based on a decomposition of design work into individual design tasks governed by fairly simple models of individual problem solving of utilitarian choice rationality and such individual problem solving activity is hardly traceable in empirical studies of design work. Where these have been particularly closely studied, the design work of individuals seems rather to be highly opportunistic and socially situated (Visser, 1990). Secondly Blessing points out that prescriptive models tend to associate the progression of design work with a well-defined transition from one development phase to the next (for example the transition from concept design to detailed design). In the empirical studies such transitions are found to be unclear and often arbitrary, indicating that actual design work is iterative and exploratory. A possible consequence of Blessings studies is to shift focus from the completion of (individual) design tasks to the staging of (collaborative) design events, when organizing design processes. Such an approach is particularly relevant for a partner engaged design process, because design work here is situated at the fringes of each of the partners own development organizations.

Participation and reification

Wenger understands collaborative work as an alternation between participation and reification (1998). In his study of work in insurance companies, he describes how clerical workers alternate between discussing and constructing legal arguments based on the evidence in a particular case in a participatory fashion, and acting based on the groups reified standard exemplars. Elsewhere, he has suggested a similar pattern in design work (Wenger in Binder, 1996). Schön (1983) describes the process of designing as a conversation with the materials of the design situation exemplified with the sketching architect going through a cycle of seeing-drawing-seeing in her engagement with the plan and section drawings of her trade. In a collaborative design session bringing together a diverse group of professionals, each with their own practices of framing and representing their respective design games, it is not obvious how such a conversation can become a collaborative endeavor, and the alternation between participation and reification has to be taken into account. A number of authors have suggested to see these design sessions as a meeting of language games, and have argued for the need to create shared design artifacts that can span the gap between these language games (Ehn 1988; Bödker 1990). Studies of collaborative design practice indicate that such shared artifacts should be seen as what Leigh Star (1989) has termed boundary objects. They may be shared but they do primarily tie together the different collaborating groups by allowing for different interpretations within each sub-community. Henderson (1999) has studied the use of assembly drawings in the engineering factory. She finds that these drawings play an important role in tying together engineering work, as they are circulated between the different groups in the factory. As they are circulated they get annotated and modified, and in this way they carry the imprints of their interpretations. She calls the drawings, conscription devices as they form the glue that ties the activities of the different groups together. For a collaborative design session to be successful we therefore have to look for design artifacts that enable joint "conversations" at the same time as they allow for plasticity and ambiguity that make them suitable boundary objects.

"THE EXPERIMENTAL OFFICE" – PROJECT

Together with a consortium of four different partners (a supplier of IT hardware and software for office environments, a telecommunication company, a furniture manufacturer and a real estate company) the Interactive Institute has been setting up an Exp eriment Office for the future. It is a work environment where different project organized companies will be invited to try new workplace arrangements and technology. The Experimental Office will be equipped with technology from each of the partners involved, and it will be a full functioning office that one or two workgroups temporarily inhabit and use. The office is thus intended to accommodate for actual office work. Our role was to organize and facilitate the concept development process of the Experimental Office.

1. In the first design workshop different stakeholders gathered around a table containing design material of different kinds.

The design work was organized around three workshops. The first aimed at setting the "stage" for future office work, the second introduced the "props" for supporting activities in the form of IT products. At the third workshop we arranged for the participants to stage scenarios of new work practices from the perspective of the individual worker.

From a research perspective the project posed two major research questions. First the partners where by a large typical business representatives of their respective companies. We wanted to find out if a practice oriented and collaborative design process along the lines suggested in the literature on participatory and user-centered design would make sense in such a setting and what kind of sense it would make. Secondly the project focused on developing new design solutions at the intersection of the different competencies of the companies involved. This raises the question to what extend competent design work can be accomplished in collaboration where no single partner is solely in control of this integrative design task.

For research purposes all design event were videotaped and all design artifacts collected for analysis both in debriefing session for the research teams immediately after each event and for later more detailed analysis. The research approach was also informed by action research in the way that the contributions of the research team both in terms of setting up subsequent design sessions and creating relevant design artifacts such as particular design games, were informed by the analysis of earlier events.

SEEING THE FUTURE IN EXISTING PRACTICES

In order to root our design process in existing experiences and practices we started out by doing ethnographically inspired field studies of three selected office environments.

2. The design material (video, photos etc) is grounded in existing practices of project-oriented offices.

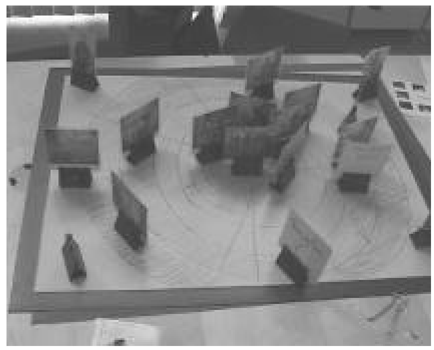
In each office one person took the role of a user representative in the coming collaborative design work. It was important for us to bring the voices of individual persons working in offices to the front throughout the process because of the large number of stakeholders with different perspectives involved. For each office site a collage of video clips was assembled revealing experiences, positive and negative, from the current work environments.

The work practice study that we conducted was a mixture between ethnographic studies using video to follow work activities and a more "work archaeology" oriented approach where documentary material such as 'work books' compiled from work place walkthroughs are used as "discussion triggers" in collaborative inquiry settings.

3. Video card nr 3."Work place archaeology". C. has put the things that she needs tomorrow on the floor, so that she wont forget them…

Inspired by the notion of video card games (Buur and Søndergaard, 2000) the materials from the practice studies were edited for a simple boardgame like design game, where participants can use fragments from the studies of existing office practices to create 'stories' of new office environments. For each person we had followed, we created a small edited video portraying this person with particular emphasizes on the way she/he relates to her environment. Out of the remaining material we made 40 so-called 'set pieces' – small video snippets that sought to capture a certain aspect of the office setting. The set pieces and video portraits were each represented by a small laminated picture that could be placed on a 'gameboard'. The gameboards were intended to be fairly generic conceptual maps with labels such as 'important things in the middle' (concentric circles), 'everyone will sit by the window' (an outlined square frame) or ' many centers' (several radiating circles).

With this setup the participants were asked to collaboratively create images of future office environments using the portraits, the 'set pieces' and the gameboards they found relevant.



4. In workshop 1 all groups choose a game board where the important things should be placed in the center.

In our work the result of the study is not treated as "data" but as something to collaboratively explore and work with to build visions about the future. Many authors have argued for the relevance of letting practice studies inform design. However Plowman suggests making the process "informing design" explicit (1996). Gaver et al. describe their design material for instance postcards and photos describing everyday activities as cultural probes (1999). They see such materials as purely inspirational and use it "to play around with the truth". The approach has some resemblance with what we have done. We let the workshop participants work with the design material as they find it suitable from their competent view. But it is in our case not merely to "play around with the truth", but rather to use "true" images of existing practices as "building blocks" for visions of the future.

The story about 22

"22" does not tell all readers the same; there is an ambiguity in what it represents, until there is an agreement about it. In one of the workshops a card (number 22 of 40) was used to represent a wish or opinion in one of the groups working with framing the design problem. The card had a picture of a meeting room with a conference telephone. The participants used it as a representation for a "soft meeting room, for low tempo meetings". The discussion initiated by the card was that there is a need for different kinds of meetings and therefore different meeting rooms. The soft meeting room was explained as the place where ideas could be generated and books could be read. Meetings that should be held short needed another setting and should be held elsewhere. As the work went on, the participants often referred to "the 22" and held the card up, while they discussed how things should fit together. When they did this it was obvious that they did no longer just talk about the "soft meeting room" but referred to the discussion that they had in relation to the "soft meeting room", concept. The workshop participants made the design material their own and transformed it into what they considered important.

5. The "set piece" number 22 – a soft meeting room

Offside

During one workshop the 'gameboards' played a rather important role of making the participants take stances to the design material. In one of the groups a discussion about what was wanted and what was definitely unwanted arose, this resulted in a change in their gameboard. The participants created two "offside-corners", one for things that just should be removed, and one where they placed things that should be available but not in the same way as we currently know it. In this case the participants actually extended the 'rules of the game' and imposed a new complementary scheme of 'what is in and what is out'.

The role of "work practice" in design

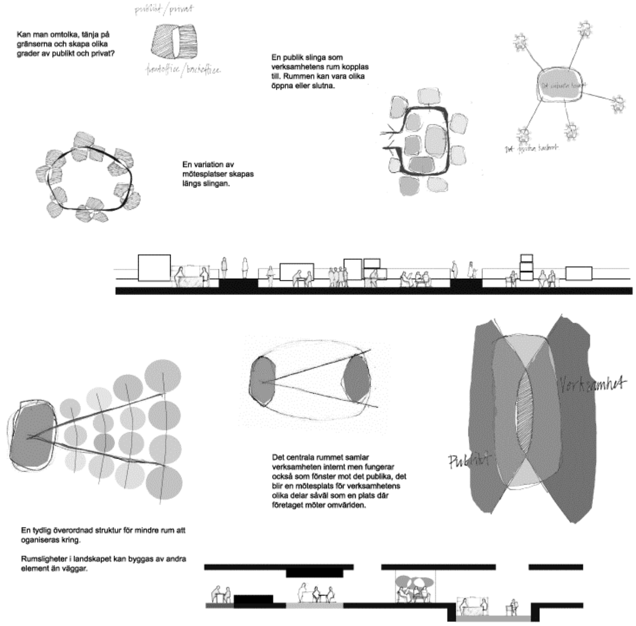
In contrast to Gaver et al (1999) we claim that the design material used in the way described above, not primary works inspirational, neither does it play the role of being informative, as "hard data". It is an open grounding that functions as an explorative and creative starting point for the design work. At the same time it sets some restrictions on the design assignment, restrictions created by the work practice based design material. The design material makes interventions in the design process. It pops up when it is not expected and initiates exploration of different aspects. When one group was presenting a first idea about what they found important, a participant from another group jumped in and said "On the video we saw that R argued that he sells best when he is walking around. How does that go with you idea?" The group that were giving their presentation had not thought about this, but could immediately tell us about a project where wearable computers were used by electricians on the move. The technical solution was perhaps not the most appealing for this project, but gave an insight in alternative ways of using digital technology.

A COLLABORATIVE STORY - FUTURE OFFICE WORK

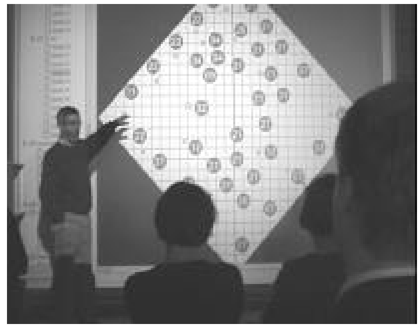
The design process stretched over four months posing the problem of establishing and maintaining a shared understanding of office work among a large number of stakeholders. Substantial efforts are required to support continuity between collaborative events in a process with many stakeholders. Preparations before collaborative events become crucial to provide a starting point where the stakeholders different perspectives can be brought together. Also, after an event there is a need for analyzing and summarizing results and bringing them back to the stakeholders, bridging over to preparations for the coming collaborative event.

Setting the stage for future office work

After the first workshop where the participants had produced their first gameboard collages of a stage setting for future office work, one of the architects in our group interpreted and summarized the results. She transformed the collages into representations of three different "stages" for office work on a conceptual level. Each conceptual stage displayed the main characteristics of the results from one of the groups, and they were given metaphorical labels to reflect these characteristics: "the path", "the eye", and "the nerve centers". For instance the stage named "the path" showed a public path through the office to which various kinds of meeting, work and project rooms were attached. Along the path previous products were also exhibited. "The eye" concept was based on the idea of a public area (the eye) where the organization met with the outside world (front-office) and a private and more quite area exclusively for the employees (back-office). "The nerve-centers" illustrated an organization having several projects running simultaneously and where each of these had their own center namely the project room. Around each project room functions such as copy machines, areas for quiet work etc. were found.



7. Interpretations made by the research team after workshop 1.



6. Game board in ForeSite Designer used in workshop 1. Here displayed on large screen

	Mine	Ours	Everyones
Small			
Medium			
Large			

8. A matrix corresponding to Weisers visions about ubiquitous computing.

Reifying the object world of stage-setting

In order to support the continuity of different stakeholders perspectives we provided each partner with a rich description of the results from our collaborative effort in setting the stage for the future office, together with the input material to the workshop. An HTML-document was developed that presented the architectural interpretations of the results from the three groups, video-snippets showing highlights from the collaborative design work including presentations of final results, and finally the forty "set-pieces" (images and video-snippets) used as input to the workshop. The material was distributed on a CD-ROM to all stakeholders. The intention was to provide a reification of the first workshop's object world including its results and this way support continuity in the story of the future office. Most important, the material also helped newcomers to enter the design process. However, as the reification of the workshop was based on our interpretation of the results it was important for us to present and discuss these interpretations with each partner before moving on. The partners were therefore visited to get their view on the material presented.

Introducing technological-props

In preparing for the second workshop we needed to provide a bridge from the three conceptual "stages" from the first workshop over to the technological "props" to be introduced in the second workshop. Based on the stages in the first workshop a two-dimensional matrix was formed to categorize the technology introduced by our partners.

One axis described how individuals would relate to the technology. We wanted to cover technology support for the individual and the designated group as well as the office as a whole, and the options were labeled: "mine", "ours" and "everyones". We also wanted to introduce a notion of scale in technology, and the other axis divided technology into three simple size categories: small, medium and large. The size categories roughly correspond to the ones introduced by Weiser (1991) when describing the technology scale in ubiquitous computing.

With the matrix as starting point we discussed with the partners what kind of technology they would introduce in the second workshop as "props" for the future office stage. As the "experimental office" was a facility being brought into full operation within a year, and we wanted our conceptualizations to be firmly rooted in problems and success stories from existing practice, the time frame of our future visions was rather short. From a technology perspective this meant that we limited the selection of "props" to existing products, or products being rolled out within six months. The other part of preparing for the second workshop was to ensure continuity in issues from the user organizations. During our visits we created basic scenarios for each participating user.

Creating scenarios about project-based work

Creating scenarios can be central in tying the design process together (Brandt and Grunnet, 2000). In the workshops part of the task was to create scenarios collaboratively. In the end of the workshops the groups presented a scenario as a short story about what took place within the future project-based work environment.

At the second workshop the groups created a story based on activities that each of the users did during a normal workday. Three groups were formed around the three users. They were the main characters in the stories and played a central role during the group work. H.'s group worked with the conceptual stage named "the eye". H is a consultant. She is almost always on the move and collaborates with several people both inside and outside the organization. At present she uses the telephone quite a lot. H takes one of the blue plastic pieces labeled "everyones" and put is on the "eyeball". She says: "If I translate my present work place with this the entrance is here, and I sit here". She takes one of the red plastic pieces labeled "mine" and places it at a distance of the entrance. She continues: "Usually we like to show our customers the office because we think it looks good and we are proud of it". Then she says: "So we use to walk a little tour in the office. On this office space the round would be here and the meeting room would then be here". She pointed to the paper while explaining. Later the group discusses technology support. H. stresses: "As we are very often out of the office I and the other consultants need technology which allows us to go into each others mailboxes and to send mails in each others names".

9. In workshop 2 the participants built scenarios for the abstract "eye gameboard".

ENVISIONING THE EXPERIMENTAL OFFICE

When IT professionals, furniture designers, facility managers, architects and telecommunication developers are embarking on a joint development of an experimental office, it is not likely that they will ever express their design in compatible terms. The IT professional may describe the office as an ideal setting for his concept of personal area networks. The facility manager may describe it in terms of its congruent basic structure providing opportunities for flexible adaptation to changing needs. And the furniture designer may put emphasize on the novel integration of interaction technology in the core furnishing elements. On a conceptual level these differences can not be reconciled without giving up the different professional perspectives (that motivates the collaboration in the first place). On the other hand there is only one office to be built and as each of the participants one day will pass through this environment, it will give raise to all these different stories.

Earlier work where we have been engaging various visualization tools in collaborative design of architectural spaces has shown that visualizations that allows for an immersive engagement with an envisioned environment creates a fruitful ground for joint evaluations even with very diverse groups (Fröst et al., 2001). The enactment of design suggestions in formats enabling participants to confront the design artifact with what could be called a participant or full-scale perspective immediately evokes contextualized appropriations. Different participants still perceive the design artifacts rather differently, but they can literally point to what calls forward their appreciations. We have also found that establishing such an "immersivenes" is not particularly dependent on overtly naturalistic representations with for example photo realistic visualizations of an architectural space (Fröst and Warrén, 2000). Of much greater importance is the possibility to explore the design artifact without a preconceived conceptual scheme.

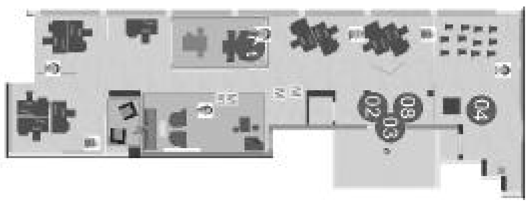
If immersivenes provides a common ground for appreciation of design moves, it is however less supportive for new moves. To productively engage in design conversations participants need access to more birds-eye-like observer perspectives that enables them to grasp a conceptual totality which is not available when immersed in a particular design vision. In the different professions such conceptual sketching tools are well established whatever it is the architects diagramming or the system designers flow charts. For designers collaborating across professional boundaries new but corresponding concept design games has to be established. As proposed also by Horgen et. al. we have found that various boardgame-like design games suggesting basic play with the spatial ordering of elements, are interesting formats for collaborative sketching activities.

In an earlier project we have developed a visualization tool: ForeSite Designer, where we have attempted to accommodate both perspectives. ForeSite Designer has an interface for placing and spatially organizing geometrical elements on a 2D surface. At any given moment this configuration can be compiled into a freely navigable 3D visualization (based on the widespread computer game Half Life). The 3D world created can be explored very much the same way as a conventional "shoot-them-up" computer game. In the Experimental Office project we have used ForeSite Designer throughout all design sessions.

9. The participants created stories within a chosen 3D scenery with ForeSite Designer The sceneries where equipped with technological props.

A snapshot: From boardgame to 3D world

At the first Experiment Office workshop mixed groups are gathered around a table. In turns they have to pick a picture from a pile of forty pictures from an existing office environment. They explain to the others why they have chosen that particular picture and together the group views a small 1-2 minute video associated to the picture. Afterwards the one who have chosen the picture has to place it on the board. The board has concentric circles in different colors. Camilla has chosen a picture of a room for relaxation. She places it at the periphery. It must be away from the busy areas, she explains. After a while the board is filed with many pictures, and the notion of center and periphery has been heavily negotiated. Two things stand out. The center should be like the heart of the office. Here past and present projects must have visibility and people should gather here to work collaboratively. The center is also where you bring in close customers to make them see the trophies of the past and make them engage in future challenges. Radiating from the center are more diverse areas of individual work and contemplation. An overall zoning is seen as “slices of a cake”.



10. Building an actual concept for the Experiment Office. Walls, Furniture, Technology, Persons- All have its own representation. A plan drawing from one of the groups in workshop 3

After some hours the board configuration has to be entered into the 2D layout of the ForeSite Designer tool. An initial “visit” to the 3D world of ForeSite Designer shows the group two new issues to deal with. The floorplan is rectangular with no markings on the floor and the entrance is in one of the corners. The group starts discussing and writing on the white board. Could the center be “dragged” towards one corner? What about the “edges with a view?”. The pictures are one by one placed on the 2D layout. A configuration later called “The Eye” is emerging with a steep and short entrance zone and a considerable depth partitioned in three different “slices”. The deepest zone for the most part without direct access to the windows holds the common functions: copier, meeting rooms and towards the far end (with windows) relaxing area. The two symmetrical zones along the window surface hold project work areas, soft meeting areas and individual work places. On the 2D layout things start to looks pretty good, but after yet another “visit” to the compiled 3D world new problems arise. The center of the “Eye” is surely interesting and the adjacent areas where the three slices come close provide interesting opportunities for functional crossover. But further into the space the “Eye” does not impose sufficient order. New suggestions come up. Perhaps small clusters forming concentric ribbons along the perimeter would be something. The group turns back to the table with pictures and the 2D layout to work it all over again…

Making it concrete: Respecting constraints

In the preparation of the third workshop the research group was discussing how we could sustain continuity from the other workshops. A suggestion was that the sketches made after the second workshop should be redrawn with the up-coming workshop in mind. However, this suggestion was rejected, and it points at something interesting. The project had moved on both on the design concept level as well as on the strategic administrative one. The location for the future office had been decided, and the diagrams that were used earlier would not be applicable between the walls now setting constrains for our design work. To continue with the same diagram concepts would be to ignore the particularities of the chosen location. The new constraints set by the actual building became something that made the project come into a new phase, where the participants realized that the process would have to come to a closure within a rather short while.

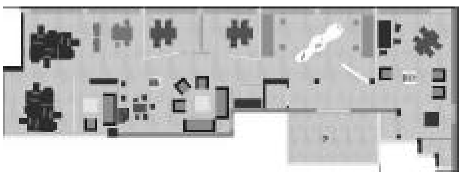
For the third workshop we chose to be very explicit about the restricting constrains that we had. We made 2D architect drawings and in the 3D world we adjusted the setting so that it corresponded to the actual building for the office, we took photographs of the view from the office and inserted these as a background outside the windows in the office. The building blocks we used inside the 3D office was still sketchy, just representations of “what could be”.

11. A 3D visualization of the concept in figure 10. In the foreground a representation of a “Digital Reception”. The white signs illustrate technology integrated into the office.

The clear distinction between what was possible to work with and what was already decided was important to us, to get the continuity of the project and give the participants a feeling of getting forward.

DISCUSSION

Modern workplace design demands new design methods. Innovative workplace design is no longer just a question of architecture in the sense of spatial arrangement and furniture. Technology has to be designed simultaneously and be integrated with spatial design. This will be even more so in the future, when interconnected technology, in line with the vision of “ubiquitous computing” will be part of work place design.



12. After the workshops the research team made a summation design based on the group presentations from workshop 3

The Experiment Office project has explored approaches for collaboration in multi partner, cross competence design processes. The goal was to create a successful "Design Lab" for collaborative inquiry and design. The design work was grounded in collaborative inquiry into existing project-based work practices and from that an innovative concept for a future office workplace was developed. The grounding exercise with the video cards made it possible to *identify and play around with* important office "set-pieces". To start a collaborative inquiry and design process we will argue that components at hand to play with are important. The cards and video snippets speeded up and concentrated this process. They constituted a common ground and frame of reference for the participants by trigging individual comments which where processed in shared exploration and reflection. In this way the "set-pieces" and later the other design materials where identified and associated with collectivly agreed connotations.

13. One of the results from the Experiment Office project - A concept proposal for an actual office.

The boardgames and other design material forced the participants/players to make *priorities*. For instance, in the first workshop the groups had to decide if the "set-pieces" where to be considered as important or not. The groups had three different gameboards to choose from, where the important components were supposed to be placed differently - in the center, in several centers and along the windows. At this stage in the design process it was apparently difficult to make more elaborated distinctions so all the groups chose the one with the important components in the center. The introduction of the ForeSite Designer interactive design tool opened up for the possibility digitally to *relate* the components spatially to each other and to build 3D spatial arrangements with the components. At first this was done rather schematically but in the later workshops it was possible for the participants to build up the detailed scale models integrating space and technology. Collaborative scenario building helped in tying space, technology, and work activities together. They filled the office spaces with meaning, made non-fits manifest and initiated *change and development* of the elements and their relations.

To succeed with setting up collaborative workshops that involve a diverse group of people with various backgrounds and interests requires that each person can see a purpose in participating. In the "Experimental Office" project the partners and the office work representatives had a joint mission to design a concept for a future office workplace. Everybody had different views of what constitutes an office and what is taking place there. Still this was what tied them together. We made use of this as a starting point for the design work, and created therefore design material based on work practice studies.

This design material created a common ground that everybody could relate to but at the same time they acted as things to think with. The staging of the collaborative workshops made it possible to play around and create stories with the work practice based design materials. The design materials functioned both as grounding for the design work and as a boundary objects wherein different participant can read and interpret the material differently. In partner engaged design it is important to use design materials that are so rich in content that it functions as boundary objects spanning the gap between different understandings and/or interests.

The workshops where arranged to promote active participation. The continuity in the process is here something that the setup has to handle carefully as it is important that the participants feels that the design work is going forward, and that the explorations they have done previously is recognized in the following process. One difficult part of a collaborative design process is when you open up the design process to involve more people it can be hard to create continuity in the engagement. It is therefore important to be familiar with the mechanisms that can support commitment and team building.

The "experimental Office" project shows that it is possible to unite a group of diverse stakeholders on a concentrated common assignment and get a convincing, agreeable result out of it with the described design approach. We believe that the idea with the "Design Lab", the way the design process is organized around collaborative workshops with the use of design materials and the rules for participation are worth modeling in other projects. Compared to methods focusing on collecting knowledge and requirements a partner engaged design process seems to utilize the competences of the people involved to a greater extend.

The concrete result from the design approaches developed and used for the Experimental Office project, is a completed concept proposal of an actual office layout with integrates information technology solutions. A selected executive group among the participating companies will further rework the concept to a final realizable solution.

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Centering Diversity;
An ethnographic dissection of hemophilia care

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ABSTRACT
In this paper, I describe my entry as a 'change agent' in the dynamic site of a hemophilia care center (HCC) in a Dutch university hospital. I discuss the importance of using participant observation to create insight into the interpretative flexibility of the site, by showing the presence of diverse interpretations by various actors on different moments of 'what the HCC is' and what it means to 'make it work'. This reality contributed to a variety of roles that were ascribed to the researcher – a process which I took as a valuable source of information on the site. I conclude that, for interventionist research in a complex setting, it is of utmost importance to use a methodology that sensitizes the researcher for the different and changing views that exist on that setting. This allows one to become aware of the various roles that one is asked to play, and the solutions one is expected to come up with. With this sensitivity, a researcher can choose to intervene by giving voice to a certain interpretation, or at least avoid suggesting solutions that are bound to fail because they are contradictory to interpretations of strong actors on the nature of the setting.

Keywords
Ethnography, interpretative flexibility, ethnographically informed IT design, hemophilia care centers

INTRODUCTION: CENTERING HEMOPHILIA CARE

Hemophilia is a rare hereditary clotting factor disorder that is found in some 1500 people in the Netherlands. These patients are divided into three groups: light, mild and severe hemophiliacs. This division is based on the level of coagulation factors that is found in the blood, and patients in the various groups may experience substantial differences in the consequences of their disease and treatment. Whereas a middle-aged patient with severe hemophilia may suffer from immobility due to damaged joints as a result of sub-optimal treatment during childhood, and may easily use up to €50.000,-- worth of coagulation factor concentrates, a young patient with light hemophilia may hardly ever notice any effects of his [1] disease nor need to take any medication. In the Netherlands, virtually all severe patients, and some of the mild ones are on home treatment. This means that they are trained in diagnosing and administering medication themselves, without having to depend on healthcare professionals for their daily treatment.

As a consequence of the variety among patients, care providers have indicated that there is a need for combined care from a hematologist, medical social worker, orthopedic surgeon, medical psychologist, physiotherapist, rehabilitation doctor and oral surgeon [9].

With this diverse and small group of patients needing complex treatment with expensive and scarce medication[2], the Dutch Ministry of Health in 1999 proposed to appoint hemophilia care centers (HCCs) to concentrate the care and provide this multidisciplinary treatment [3]. This was to prevent the scattered care leading to sub-optimal treatment. The policy that set the standards for the desired care was based on the consensus on hemophilia treatment as constructed by healthcare professionals [12]. This consensus was initially composed to indicate 'ideal' treatment – while professionals realized that many a times

[1] The use of 'he' and 'his' is, in regard to hemophiliacs, not a sign of sexist language: patients can only be men. Women can merely carry the disease.

[2] Approximately 80% of hemophiliacs worldwide are not receiving any form of medication. The vast majority of these patients live in 'developing' countries.

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reality would be less manageable – but is now taken as the norm that the HCCs should live up to. The boards of directors of various hospitals were asked by the Ministry it they wanted to be candidates for the status of the HCC, and after a selection, sixteen centers were appointed. Since it had been stated from the beginning that no extra budget would be allotted for the development of the HCCs, nor for providing the care, the centers now faced a substantial challenge; to change the organization and quality level of care to meet their self-set aims of ideal treatment, without any extra means being available.

The idea was expressed that a part of the challenge could be faced by developing and introducing certain forms of information and communication technology (ICT). Four aspects needed to be dealt with according to the internist-hematologists at the HCC. First, a multidisciplinary care team was to be put together by installing protocols and by facilitating communication among members. The idea was that, for such a care team to function properly, participants should have access to the patient data and therefore an electronic patient record (EPR) was considered of importance. This was the second aspect. Thirdly, improving communication with patients was seen as instrumental in optimizing home treatment and the Internet was seen as a technology that could support such developments. Last, the logistics and registration of the coagulation factor concentrates needed to be improved, if possible via barcode scanning of medication that would directly be registered into the EPR. It was in this setting that I entered one of the HCCs at a Dutch university hospital. Being interested in how organizational and technological changes are brought into being and in ICT development in healthcare, I started a study on how solutions were constructed for the problems that were seen as fundamental. This was not a distant perspective on developments that were instigated by other actors: in the process of providing solutions I was to have an active role. I entered the setting as a 'change agent' and had the explicit aim of supporting and bringing about transformation.

The interventionist nature of this project stems from the idea that action and the development of theory can support each other. The apparent relationship to action research and how my approach differs are beyond the scope of this paper. In this article, I will focus on the advantages of using ethnographic methodology in a highly flexible research setting. I will discuss the importance of using participant observation to create insight into the interpretative flexibility that is found when dealing with a dynamic institution. I will do this by showing that diverse interpretations by various actors on different moments of 'what the HCC is' and what it means to 'make it work', contributed to a variety of roles that were ascribed to – or chosen by – the researcher. I will conclude that, for interventionist research in a complex setting, it is of utmost importance to use a methodology that sensitizes the researcher for the different and changing views that exist on that setting. This allows one to become aware of the various roles that one is asked to play, and the solutions one is expected to come up with.

ETHNOGRAPHY AND CONTROVERSY

Controversy and change have since many decades been a key interest for researchers in the field of Science and Technology Studies (STS). While initially there was a strict separation between the context and the content of science and technology, in the 1970s a shift took place within this field. Several researchers started seeing any encountered difference between social aspects and outcomes of technoscience as produced during the design process. The separation of 'the social' and 'the technical' itself was considered to be constructed, and therefore this perspective has been called 'radical constructivism' [6, p. 72].

A method that was embraced by researchers working from this perspective is ethnography. They found this approach suitable to show how order is constantly created by making certain perceptions on reality more plausible than others. The central question in such studies is no longer 'why' controversies find closure and stabilize, but 'how' this happens. Where STS researchers initially "used the most outdated version of anthropology" (10, p. 146)[3] of trying to be a 'fly on the wall', there has been a substantial development in which the interpretation has shifted to participant observation. Here the definition of ethnography is much closer to that used by anthropologists: "[Ethnography] means talking to and interacting with people, and ultimately attempting to understand their symbolic worlds and *social action*" [7, p. 4, italics in the original]. It has to be stressed here that these 'symbolic worlds' are constructed, but not merely *socially* constructed. These worlds are made up of hybrid elements in which both human and non-human actors perform their ordering activities. I will turn to examples of this construction process in the section called 'Countless Care Centers'. Similarly, there has been a strong influence of ethnography on the field of Computer Supported Cooperative Work (CSCW). Though there is an admitted complication in "enabling designers to *utilise* ethnography", it is the "ability of ethnography to describe a social setting as it is perceived by those involved in the setting (the archetypal 'users') that underpins its appeal to designers" [8, p. 147, italics in the original].

Because of the fruitful studies that have come from STS of complex, changing and controversial settings using

[3] Quoted in Hess, 1992 [7]

ethnography, and the interesting cases from the field of CSCW integrating ethnography and design, I also adopted the approach of participant observation to construct my ordering of the HCC. The balance of participating or observing has shifted many times[4], since I was also expected to contribute to solving the problems that were perceived. The ways in which I did this were very diverse as a result of the insight that intervention is a strategic activity manifesting throughout a research project. It is not just the closing phase following the period of doing fieldwork[5]. The fact that various actors expected me to intervene influenced the number of roles that I was expected to play according to them. Before turning to these roles, I will first dissect 'the HCC'.

COUNTLESS CARE CENTERS

A concept that has been coined to describe the existence of multiple perceptions on a technology, an institute or a scientific fact in an early stage of its development is 'interpretative flexibility' [1]. This concept can be used to avoid "any implicit assumption of linear development" [2, p. 6], which is one of the main aims of STS research. Having originated from the social construction of technology (SCOT) approach, it has mainly been seen as a way to describe how various 'relevant social groups' view an object differently. Here however, I would like to stress that the HCC was not just seen differently by various groups, but also differently by the same actors at various times. When realizing the variable nature of interpretations over time, this concept is highly applicable to the setting of the HCC, and allows me to tell the story on how the interpretations differ. It will become apparent that the change process itself was instrumental in the variation of interpretations.

Questions that proved to be illustrative of the interpretative flexibility were: 'What is the HCC? and 'How do we make the HCC work?' The clearest, and most explicit answer to these questions came from a representative of the Dutch Association of Hemophilia Patients. This informant reacted as if bee-stung: "What do you mean 'to make it work'? It is already there! The Ministry has appointed them, so they already exist." For her, discussing the present functioning of the care center was out of the question: it *already existed*. All the aims were laid down, and now it was just up to the care providers to live up to these standards.

Initially, a rather opposite reaction came from the internist-hematologist, who was my key contact at the center. He stated that we had to be very careful, because: "if we don't make the HCC work, we may be closed down. I think that is a real risk, and the more so for some smaller centers. The only center that would then remain is the Van Creveld". The fear of being closed down, and the resulting perception of the HCC as a *threatened unit* was initiated by the way the implementation of the policy by the Ministry was presented. The initial demands were that a formal examination with direct consequences for the continuation of the status of the HCC would follow within one year. Since the problems were substantial, this informant seriously doubted the chances of passing the test.

The perception on the viability of the center altered after a big reaction came from medical professionals. They expressed their discontent with the state of affairs concerning the implementation of the policy in strong words to the Ministry. This changed the ministerial aim of 'examining' the centers from a formal exam into drawing up an inventory, which diminished time pressure to shape the HCC substantially. This also seemed to transform the perception of the internist-hematologist on the HCC. Instead of the center being threatened, he became eager to show it as an *efficient unit* in the hospital. This interpretation came to the fore when we were discussing a paper I had written for the hospital pharmacy to indicate the amount of finances that were being lost due to sub-optimal registration and logistics of coagulation factor concentrates. I carried out this investigation in order to generate budget to employ an extra person at the HCC dealing with medication, and to increase my credibility at the site (see the section 'Nine Lives in a Hospital'). The internist-hematologist was called to the Board of Directors of the hospital after they received a copy of the survey that he had filled out and sent to the Ministry as part of the inventory. He had filled it out quite strategically, focusing more on problems then on achievements and now assumed he would have to justify himself for the way he had represented the hospital. He said: "I would like to bring this paper along to the Board of Directors. It is good to show them that we do quite a bit more then just filling out inventories here!" The very changes that were taking place in the setting enabled him to adjust his interpretation of the HCC, and state that we were turning it into an efficient unit.

When I arrived, the 'multidisciplinary care team' that I expected to find turned out to be nothing but a number of individuals, not meeting at all, not knowing what procedure to follow in case a hemophiliac would show up; not showing any characteristics of a 'team'. During my stay there, the care providers of the team started meeting, and discussing patients together. Also, a protocol folder was created for all disciplines. This turned out to be a highly constitutive activity for healthcare providers since it made the HCC more and more tangible in the hospital

[4] A common problem for ethnographers, which is dealt with elaborately in Hughes et al., 1997 [4].

[5] The point made here is further developed in Zuiderent, 2002 [15].

environment. Even though it proved difficult to implement the protocols they did give guidance to the discussion among the various disciplines. For the professionals from other disciplines, the HCC was starting to work this way: the *care team* started functioning.

Upon arrival, one of the important activities of the hemophilia nurse was her dealing with all the contacts with industry. She would maintain her own stock of coagulation factor concentrates, get product information, order medication and receive the sales managers when they came to visit. She stated that this was definitely improving the quality of care, and should be a task that should be carried out by her. She realized that most patients hardly ever saw a doctor, and in general administered their own medication. Therefore providing them with the proper medication was the most important function of the HCC. It made her situation on the outpatient clinic of which the HCC was part special, and it defined the working of the HCC as operating her *own shop*.

This definition was a thorn in the flesh of the head nurse of the integrated outpatient clinic hematology/oncology. When giving me a reprimand after a meeting (see the section 'Nine Lives in a Hospital') she stated that it was of utmost importance that: "we shouldn't return to the situation where the hemophilia is something completely different, with different privileges and all. That was the case when I came here, and I was told that was exactly the problem with this clinic!" For her, making the HCC work was to keep it as an *integrated unit*. She tried to install this interpretation by rotating the nurse as much as possible to the other positions in the clinic, and by stressing in meetings that officially there doesn't exist such a thing as a 'hemophilia nurse' in the Netherlands. She also insisted on the fact that there was no permanent function for a nurse dealing with hemophilia: the work was just part of the activities at the outpatient clinic.

However dearly she may have wanted to describe the clinic as integrated, other actors enforced the definition of the center as a *separate unit*. One of the decisions made in the working group that was formed for the HCC[6] was that a PC was needed for its development. The perception of the head nurse that the center is based in, and part of an integrated outpatient clinic for hematology/oncology was challenged by a non-human intervention. In the clinic the nurses work with 'dumb' terminals that provide access to the hospital information system (HIS) through the hospital's mainframe computer. The PC was to be placed on the desk where the hemophilia nurse was sitting most of the time, and was to replace the terminal. After having decided on the need for a computer however, it turned out that the network box to which it was to be connected was a dummy: it was merely a box, with no cable leading to it to connect it to the hospital network. As a result, the whole ceiling would have to be opened in order to provide such a connection. In a crowded outpatient clinic, this is close to disastrous, and the head nurse quickly arranged for a room to be allotted to the HCC. Though the head nurse was trying to factualise her interpretation of the center as integrated, the alliance of the PC and the box provided the irrefutable argumentation for obtaining a separate place designated to the HCC.

The discussion on the logistics and registration of the coagulation factor concentrates led to another interpretation of the HCC. Among participants of the working group, the view became dominant that the position of the hemophilia nurse would have to change. Not only were her tasks concerning registration seen as secondary to a nurse's job – and this in a clinic with a serious lack of nurses – it had also turned out to be costly since registration was not optimal. It was decided that an extra position would be claimed for an assistant pharmacist to be employed. A part of the time that would become available was to be used for installing a nurse-led home treatment clinic. Before this was actually operating, the nurse one morning asked me: "Are you having any appointments today? Because I have my first nurse-led consult today". She said it with a lot of enthusiasm, and what it means to make the HCC work slowly seemed to shift from running her own shop to creating an intensified *nurse-patient relationship*.

Based on these observations on the different ideas on what it means to make the HCC work, the range of interpretations of the center can be seen in Figure 1.

These various interpretations can be seen as part and parcel of the early stage of the development of the HCC. Since not much has been agreed upon, there is much room for interpretation, and while closure starts to take place, interpretations are changing accordingly[7]. This variation is not without consequences for me, as a researcher, who entered the setting as a change agent, and is seen as someone who can help materialize a certain interpretation. As a result of this there was a large array of roles that I was expected – or trying – to play. Besides that, some roles seemed to emerge due to my prolonged stay as an ethnographer. To these various roles and their different origins I will now turn.

[6] Another constitutive activity.

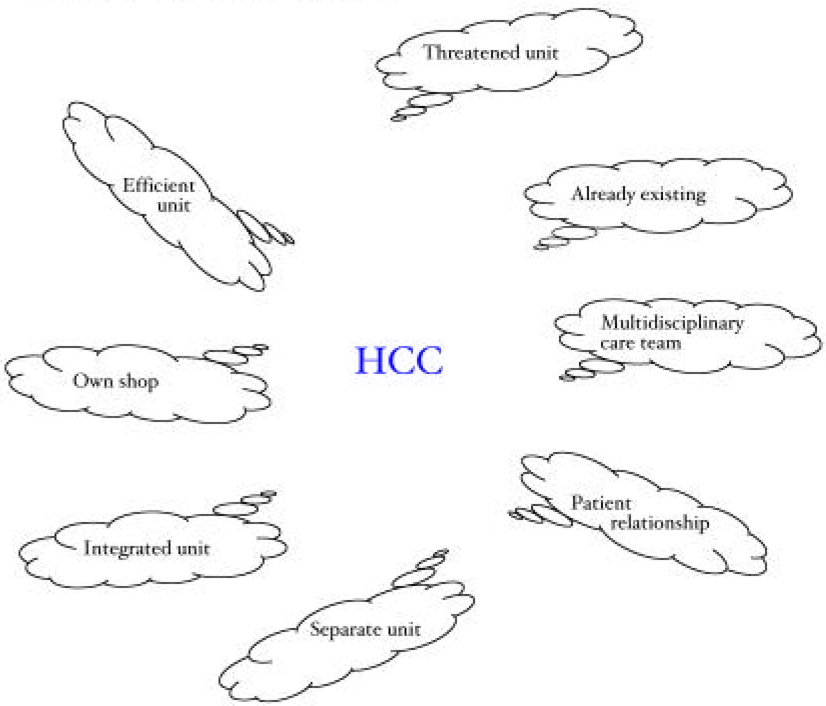
[7] This does not necessarily mean that actors start agreeing on the interpretation: actors may fight even harder to make their interpretation heard once another perspective is gaining terrain.

CLOTHES MAKE THE MAN: GET A LARGE WARDROBE!

When I entered the research setting, it soon became apparent that the level of flexibility required by me was substantial. Due to the various ideas of what the center is, and the stakes that are involved for different actors, I found that many a times roles were being attributed to – or enforced on – me that stemmed from a specific interpretation of the HCC. Also some roles seemed to arise as a result of my presence as an ethnographer. And besides all this, of course, I tried to position myself and adopt roles strategically. For this, an instrument that was at my disposal, or rather, that I tried to use was a large wardrobe. This is a well-known ally of an ethnographer when facing various groups within one setting[8]. But of course, I could only do so much to divert the attention of my informants from the roles they wished to ascribe me.

At first, I was rather cautious of these different roles, and felt somewhat threatened by the idea that my informants were trying to 'use' me for their various goals. However, it didn't take long for me to start taking comments on my work and roles being ascribed as valuable sources of information on the setting I was researching. This shift in perspective turned a stressful situation into a rich source of data. The anthropologist Mascerenhas-Keyes states on this issue that: "since stress seems to be a *sine qua non* of fieldwork (…), rather then escape from it I suggest that we could usefully integrate it into fieldwork methodology" [11, p. 189]. Without wishing to elaborate here on the way she relates this issue to concepts from psychoanalysis, I did find the approach to be helpful in clarifying the roles themselves, and the information they gave me on the different interpretations of the HCC and of me.

Figure 1: Interpretations of the HCC



Nine Lives in a Hospital

In one of the first weeks of the project the internist-hematologist suggested that I should visit some of the other centers to compare existing organizational practices. He made a phone call to a colleague at the largest HCC in the Netherlands in which he said: "We have a *logistics manager* employed here, who would like to take a look at the whole logistics of coagulation factors at your place". I interpreted this remark as an indication that he was positioning himself in a strong way towards this other center. He was still seeing the HCC as a threatened unit and wanted to show that we were doing all we could to get the center organized. The role of an added direct employee was strengthening his position much more than portraying me as an external researcher.

A somewhat similar, but more broadly defined role was that of the '*project leader*' in the HCC. This was a role that I

[8] For an interesting account of the way dress was used in order to deal with different groups in an anthropological study in Goa, see Mascarenhas-Keyes, 1987 [11].

partly took myself, and that simultaneously was attributed by the internist-hematologist. My choice for this role became apparent just before the first meeting of the project group. Since the aim of this meeting was to present possible directions to pursue our organizational change, I had attempted to enhance my credibility by dressing more formally then in the time prior to this meeting. The suit I was wearing was – by managers well known – an ally in the attempt to start an organizational change. As I walked in, the internist-hematologist saw I had dressed more formally, and being quite content his only remark was: "Very good! I will buy you a tie some day". Apparently he wanted to stimulate this development into a more managerial position for me, seeing the need to do much work to survive as a center. Therefore this role was related to his interpretation of the HCC as a threatened unit. By stating that I do own a tie, but that I just don't like to wear one, I indicated the boundaries of my managerial intentions.

In a very different setting, the head nurse called me into her office right after a meeting. When I entered she closed the door behind me saying: "So, that door we *fully* close…". After this, she gave me a reprimand like one can only give to an employee that's much lower in the hierarchy and that has stepped out of line. She had been quite displeased with the tone of something I had said during the meeting, and said she didn't appreciate me being cynical at all. Besides the fact that it was highly puzzling to me to understand what she meant – since I hadn't intended any cynicism during the whole session – it was interesting to be seen as an '*employee*' all of a sudden. For this scolding to take place a high level of integration in the setting was needed. This may very well have occurred due to my prolonged presence in the outpatient clinic and direct contacts with the hemophilia nurses, and therefore it could be a direct result of the ethnographic approach. But besides that, it seemed to indicate that I formed somewhat of a threat to her interpretation of the HCC as an integrated unit. Since my arrival, the separation of the center from the outpatient clinic had become more material, and it seemed like she wanted to strengthen her grip on the developments through stressing my inferior status. This became even more apparent when the conversation ended, and she stressed the importance of maintaining an integrated clinic to avoid the problems that she faced when she started her work (as mentioned in the section 'Countless Care Centers').

A role that I adopted mostly in the early phases of the project was that of '*ignorant eyes and ears*'. Since this phase consisted mainly of observing the medical practice, it was important to gain the confidence of the nurses. Therefore, in this phase, a substantial modesty was needed. This role was performed by asking many questions, by following the nurses wherever they went, not interrupting them when they were engaged in conversation, and by wearing leisure wear. Being surrounded by healthcare professionals in their white 'uniforms' made any possible sign that clothing might project much more visible. The role was also ascribed by the internist-hematologist in regard to the multidisciplinary care team. The changes that were taking place there were mainly resulting from the initiative of the internist-hematologist, and he didn't seem to need me in the organization of the care team. However, every now and then in our weekly internist-hematologist meetings I would ask him how things were developing with the team, and he would explain to me about the protocols, etc. The fact that here he didn't expect an explicit role from me, in fact enforced this distant role.

As mentioned above, at some point in the project I was carrying out an investigation of financial and procedural consequences of the practice of the registration of medication. This was mainly because it became clear that the existing process of ordering and registering coagulation factor concentrates was problematic. The hemophilia nurses took care of the entire process, and since their primary focus was on providing care to patients, erroneous registration was unavoidable. This made the process costly while simultaneously frustrating the primary care process[9]. Though participants of the working group of the HCC agreed with the importance of separating activities for the sake of registration and process-supporting activities[10], they also indicated the pertinence of being able to underline such a point with financial data, and suggested that I would carry out the investigation to obtain such data. It seemed of importance for my legitimacy in the setting to fulfill this task, since a relatively small investment of time could lead to substantial managerial changes if an extra member of the staff could be employed with the money that was traced. Therefore, I saw not much of a choice other than to take up this quite foreign role of '*forensic accountant*'. When the internist-hematologist wanted to use the document I had produced to show the Board of Directors that he was turning the HCC into an efficient unit, it became apparent why this role was ascribed to me, and similarly, the role itself made it more clear how the center was being seen.

During one of the observation sessions at the HCC, I was present at a follow-up clinic for children with hemophilia and their parents. I was sitting in the corner, taking notes and after some time the doctor had to leave the room for a few minutes. Instantly the parents started asking: "Is this for

[9] For an analysis of the problematic nature of integrating registration for secondary purposes in the primary care process, see Van der Lei, 1991 [13]

[10] An important distinction suggested by De Kluiver et al., 2001 [5].

your studies?" I briefly answered that is was for my work at the HCC, trying to cause minimal intervention in the setting, for this seemed appropriate at this time. Similarly, this role of being a *student* was attributed by some of the employees of the hospital. An oncologist who had seen me wandering around the outpatient clinic for some weeks asked me whether I was researching their clinic for my MA thesis. Apparently my informal and prolonged presence and my young age made him categorize me as a student. Finally, this role was also ascribed by the internist-hematologist in the beginning of the project. Because he saw it as desirable that I would understand hemophilia as a disease soon, he started lecturing me on the topic. Clearly he wished to invest a substantial amount of time into my training at the beginning, so I could get started soon. I thought the lectures were extraordinary, since he also could have given me a handbook or folder on hemophilia. But the urgency he experienced due to the threat of being closed down as a HCC made him invest all this time and effort.

Where these roles all seemed to stem from, or at least to be related to specific interpretations of the HCC, there were also a number of roles that were ascribed while stemming from other ideas or situations. A role that was attributed after several months on the site was that of '*adoptive nephew*'[11]. This became apparent after a protocol meeting, where a presentation of the HCC project was given to all hematologists of the outpatient clinic. In this the observational part of the ethnographic method and the lectures on hemophilia that the internist-hematologist gave me paid off during the discussion with the hematologists. I found that I had gained enough insight into hemophilia to be able to discuss on an equal level with the professionals [12], and after that meeting, the internist-hematologist was quite contented with the proceedings. He complimented me in a fatherly manner: "I am really impressed with the medical knowledge you have gained so far". After this, it was much easier than before to contact the internist-hematologist, even when he was busy. This role also came to the fore during the period in which I was involved in some projects that were not dealing with the core of my research. He then said, in a comforting tone: "But I remember so well from my own research; many times I put in all time and effort and it didn't lead to anything. You will just have to realize that this is part and parcel of Ph.D. research." This role may be interpreted as a result of the intense collaboration in this project, and has also been interpreted as being gendered. Waring [14] has described how her role as a female action researcher led to substantially different and more problematic contact with the actors at her setting than the later introduced young, male IT programmers, who were adopted instantly.

After several months the hemophilia nurse – who was by then my roommate in the hospital – was working on a sheet of lab results as she suddenly turned around, asking a question I didn't understand. She mentioned something about the lab result she was reviewing, but since I looked truly lost, she explained again. Finally I realized that what she was asking had nothing to do with hemophilia, but was related to one of her other tasks – about which I didn't know a thing. She had made a calculation on a drug dose based on a previous lab result and now she was wondering whether or not she should recall the patient to prescribe a new dose. To win some time I asked: "How long is such a prescription valid?" "Three weeks", she answered "So should I call him or not?" All of a sudden I was being addressed as a '*colleague*'. The only thing I could do was to answer that I didn't have a clue, and that I wasn't the right person to ask, but her perception of me being a colleague indicated the high level of integration into the medical setting. This probably resulted from my prolonged presence as an ethnographic researcher.

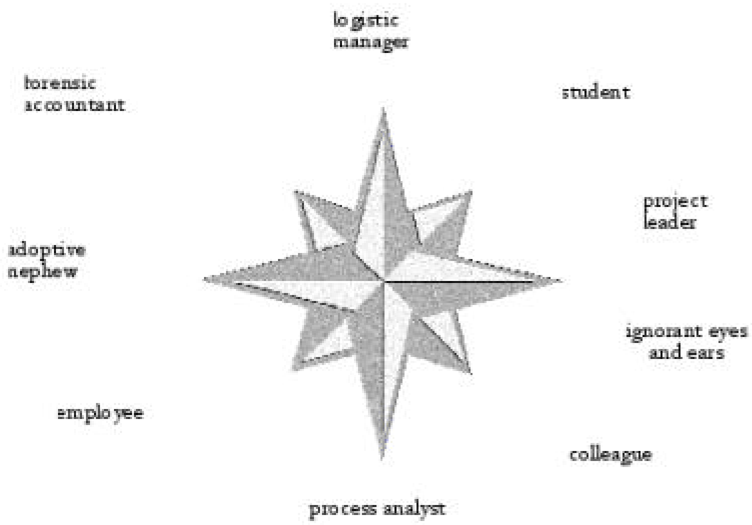
After having produced a first working document in which I made a preliminary assessment of the problems that were perceived and the solutions that might be aimed at, I discussed it with the project group member of the hospital IT department. My aim had been to provide a discussion paper that could clarify what positions were prevailing and what differences may exist; not to provide an accurate paper 'representation' of the situation. Since an organizational model was what this actor had hoped for, he stated that he was quite disappointed: "I expected that, since you had been walking around here for some time, you should have been able to give quite a detailed process description by now. You should have been able to show us where we are now, where we should end up, and the steps that are needed to go from A to B. Instead I see this report, that is very unclear to me!". His dissatisfaction could be explained by the fact that he wanted me to be a '*process analyst*'. This would be a role that he could relate to when wanting to structure and automate certain procedures. A model of the work would have made 'the center' tangible and manageable for this actor. However, his inclusion in the setting was not high enough to be able to see this as a veritable interpretation of the HCC. The role stemmed from his professional practice, that he tried to align me to.

Based on the observations of the different roles that were ascribed to me, and that I tried to adopt myself, I can draw

[11] A role that has also been observed in an action research project in Waring, 2001 [14].

[12] Note that hemophilia is a rare disease with only some 1500 patients in The Netherlands, and that for most hematologists their knowledge of treating such patients is rather basic.

Figure 2: Roles ascribed and adopted



the inscription of Figure 2.

The relationship between the interpretations of the HCC and the roles that were ascribed becomes apparent when combining Figure 1 with Figure 2.

With the thus created Figure 3, I wish to indicate that the roles that were ascribed by actors in this research setting proved highly informative of the interpretations that were present among those involved in the HCC. The three remaining roles of colleague, adoptive nephew and process analyst did not emerge due to a specific interpretation of the center, and this indicates that there are other factors to be taken into account when studying a setting, such as the gendered nature of relationships and roles.

DISCUSSION: DISSECTION AND SELECTION

The study at the HCC is still in its early stages. Though some changes have been set in motion, it can hardly be stated that the initial goals of putting together a multidisciplinary care team including all agreements with hospitals in the region, optimizing home treatment, developing an electronic patient record (EPR), and optimizing the logistics and stock management of coagulation factor concentrates, have been achieved. I mainly used the first period of the project to get a good feel for the setting, for problems that are perceived, and the variation in interpretations. The method of participant observation has been highly instrumental in obtaining information on the HCC and on the numerous stakes that are involved. The insight thus gained in both the content of the work, and in the diversity of the setting will have its consequences for the solutions that I will propose.

When entering a complex site, where change is to take place, it can be expected that there is a high level of interpretative flexibility. First, opinions may differ on whether or not any change is needed. And second, if the change is desired – or, as in this case, enforced – an array of preferred directions may be present. When a researcher is asked to assist as a change agent, it is of utmost importance that s/he first gets a thorough understanding of the *problematique* that is to be encountered. Any solution that is proposed will be favoring a certain interpretation of the setting, and therefore exclude another version. Realizing this gives the researcher the moral obligation to become aware of stakes and interpretations. As I have tried to show in this paper, ethnography is a very suitable methodology for obtaining this information. Especially the reactions to my presence and the roles that were attributed proved highly illustrative and informative for dissecting the site. This allows me to take the complexity of the setting into account when working on solutions for perceived problems. This may lead either to a specific choice to give a voice to a certain (group of) actor(s), as is seen in participative research strategies. But even if this is not the aim, then I can at least be safeguarded from suggesting solutions that look suitable on paper, but that will be encountered by many actors since it is contradictory to their interpretation on what it is to make the site work.

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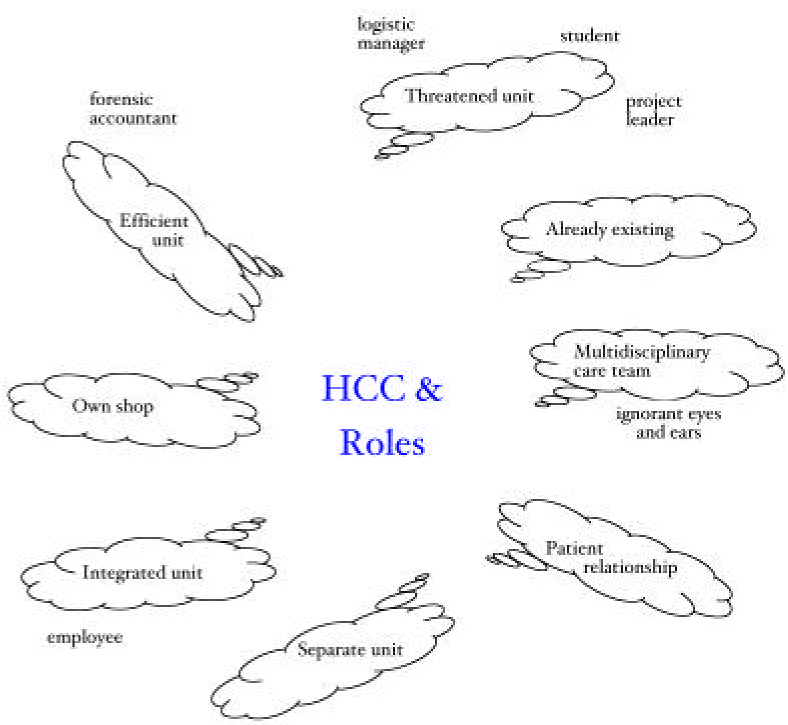
Figure 3: Roles and interpretations of the HCC



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Promises, Premises and Risks: Sharing Responsibilities, Working Up Trust and Sustaining Commitment in Participatory Design Projects

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ABSTRACT
While participatory design crosses the boundaries between technology production and use, it does not erase them. In accounts of participatory projects, the work of negotiating and changing these boundaries often recedes into the background, yet it is crucial in shaping the very nature and scope of what is achievable. In this paper, we report on our various experiences of 'boundary crossing' in four very different participatory design contexts. We argue that in each setting a key task consists of enlisting the effort, imagination, trust and commitment of users, and the sharing of risks and responsibilities. We compare and discuss the different strategies, methods we have devised to achieve this within the local politics of each setting.

Keywords: Participatory design, co-realisation, risk, trust, commitment, system biographies

INTRODUCTION
Participatory design (PD) is about drawing the real end users of IT systems into processes of design and development, and eliding the boundaries between production and use. To do this involves commitment and creativity from the different participants – in our cases, users, designers and work analysts – and a sharing of responsibility for the inevitable risks. It involves mutual respect, consideration and trust. This underlies what remains of PD as a political programme, in that in contrast to conventional design practice it may be claimed that the network of respect, consideration and trust connects different parties, and invokes different principles, with use-value predominating over exchange-value.

Participatory design invokes a harmonious relationship between the participants that is in part genuine – pursuing a PD agenda increases the pool of design ideas, reduces the risk of delivering unworkable systems and may resolve many issues in a mutually satisfactory way. But it is also in part ideological - while the PD process may ameliorate the differing interests of the parties, they do not disappear. Such differences include: PD projects, as much as other projects, may not be allowed to 'fail' because designers must report to funders and protect their reputation and access to future projects; users may wish the ends but may not wish the means in terms of time, resources and disruption; designers and users may have divergent and unstable agendas about what is interesting and useful; and not least, the parties may have market or quasi-market relations in which one's gain is the other's loss. Hence, there is in PD a *practical* politics relating to the sharing of responsibilities, the working up of trust and the sustaining of commitment, and these must be achieved in a situated manner within a constantly changing context.

A project team can only very patchily control the context within which it must operate. Technological innovations arise from, and are embedded in, a socio-technical 'system' of human practices, other technologies, and materials. The implementation of new technologies or, rather, the creation of stable and productive states within a socio-technical system that includes new technologies is fraught with struggle and uncertainties. Closely examined, it involves continuous bricolage: the often ad-hoc and creative combination of materials at hand for a particular purpose [1].

Recent years have seen the growth of closer and more intensive forms of collaboration between users and designers. For ourselves, ideas about designing 'technologies in use' [8,9,10,15], of using off-the-shelf components for quick results [10,14], of extrapolating from bricolage as a description of human-technology relations to bricolage as a design approach [6,12] have encouraged us to explicitly cross the boundaries between technology production and use, thereby bringing together system design, work analysis and user experience as three different fields of expertise. We see this as moving beyond PD as typically practised, to the 'co-realisation' of technologies [2,10]. For co-realisation, bricolage is both central and a challenge. It is a means of realising work affording ensembles of technologies, practices and procedures that

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are neither solely the province of 'IT professionals', nor too chaotic to be stable. For co-realisation, the work of bricolage is democratising and instantiates the need for interventions at a number of levels, not simply on the technological: the selection of component technologies and design choices; the embedding of the new system within the workplace; and the activities of making it 'work-affording', i.e., usable and relevant over time.

Premised on situated, immersive and sustained notions of participation, we find that co-realisation helps to deliver the promises of work-affording technologies while offsetting the attendant risks for both users and designers [10]. Critical to co-realisation is what, following Garfinkel [7] we call 'membership', i.e., being 'vulgarly' competent in the work practices of the setting. Becoming a member is the only way that IT professionals will be able to acquire the competencies as well as the rights and responsibilities that enable them to work with fellow members in the work setting. Membership takes time; hence co-realisation advocates a longitudinal engagement within the workplace. In co-realisation, the role of IT professionals is to establish a set of competencies on which to build rights and responsibilities. Thus while IT professionals deploy their technical skills, they also have the responsibility to become a member in the setting and to *facilitate*[1] the work of co-realisation. In part, this is about breaking down boundaries between 'them' and 'us'; it is also about knowing where those boundaries are and how they impact on the work of co-realisation. In this way, co-realisation takes on the politics of and in design as a thoroughgoingly practical matter, with the aim not necessarily to emancipate but to afford work practice (although these aims might well be linked).

This does not mean that we regard co-realisation as a panacea for conflict: to be sure the projects below encountered some very real conflicts and part of the work must perforce be to engage with these conflicts over time and space. Yet, we find that the types of co-operation engendered in and through co-realisation offset some conflicts by meeting them head on as a part of work: conflict and its resolution are practical matters that must be addressed within the framework of the co-realisation, as a normal, natural part of work, not as something to be avoided (we might also say that conflict can be creative).

Against this background, in this paper we explore two main questions. First, how the located politics of commitment, creativity, effort, respect, consideration and trust is 'worked into' the bricolage of design and development that characterises co-realisation. Second, whether co-realisation can only really succeed in relatively small-scale and short-term projects, or whether it can also cope with long-term, highly innovative projects.

In the following sections, we briefly summarise the biographies of different project settings and the natural histories of participation within them. By using the term 'natural histories' we wish to highlight the complex, dynamic, yet locally logical unfolding of co-realisation in particular settings. Thus it makes sense to treat of co-realisation as a situated enterprise itself realised with regard to the extant local skills mix, timescales for change and the scale of the projects. The notion of natural history draws our attention to these. We delineate instances of negotiating boundaries in projects with distinct (though nested) horizons of change: the immediacy of co-realisation projects in a healthcare setting and a practice of landscape architects; a co-realisation project looking towards the intermediate future of a manufacturing unit; and a co-realisation for a future that is 5-10 years away. We argue that in each of these cases establishing mutual trust and sustaining commitment of all team members are core issues. We discuss how trust is practically worked up in the face of specific risks and gains that surround processes of co-realisation. Our experience shows that just how those involved in co-realisation are willing, able, and allowed to participate in creating future technologies and working cultures shapes the very nature and scope of what is achievable.

DESIGNING FOR THE 'HERE AND NOW'

As part of a three year project to explore co-realisation within a busy toxicology ward in a UK hospital, we explored the use of an off-the-shelf speech recognition system to assist members of the ward psychiatric assessment team produce discharge and transfer letters. The aim was to address bottlenecks in current procedures that rely on dictation and subsequent transcription by secretaries [9,10].

It is a commonplace that technology has pitfalls as well as potentialities and in our study we found that the 'opportunity cost' in terms of training time, operating time and other related issues were 'bracketed off' at the outset: *inter alia* the time and effort of learning to use it, the risks of upsetting established routines, and the risk of finding that the system might not work in this context. Use in practice did occasion risks for those who made use of it: e.g., time was lost when trying to produce a letter using speech recognition, work was lost if there are problems with the system itself and the delivery of patient letters was made error prone in specific sorts of ways. Thus members had to sit down and grapple with the system during what are often busy working days, to undergo the periods of training required to become familiar with the system and to enable the system to recognise their individual voices. These difficulties and commitments were set against the risk that the 'experiment' itself may come to nothing; using the system may in the end not turn out to be a viable means of producing letters in the hoped for fashion.

As part of their role in the co-realisation process, the IT facilitator installed the system, trained members of staff,

[1] Hence, we shall refer to these members as IT facilitators.

assisted in use and participated in the evaluation of the system in use. The facilitator's sustained, daily presence over the whole period of the project meant that whatever the problems encountered, the users would not have to cope with the system 'on their own' as a 'finished' entity. That the system was not subject to the 'closure' inherent in other design methods was important as it enabled users to identify problems and then to work around these in cooperation with the facilitator. The bricolage approach enables a modicum of reconfigurations of the technologies used – this prevents premature closure and its attendant lock in – and provokes imagination through a dynamic assemblage of possibilities instantiated in and through work-affording technologies.

There is a need to establish some framework of commitment at the outset in order to build the technology and the social relations that are central to the work of co-realisation. In this case this was predicated on an invitation from one of the assessment team members. Such relationships presume relations of reciprocity and partially constitute a space of willing engagement wherein co-realisation can take place. As noted above, this manifested as an initial willingness to focus on the potential of speech recognition as good reason for its adoption over and above the potential difficulties (which the facilitator took pains to draw to members' attention) as reason for not doing so. Of course, this is only an initial commitment and there is a need to move on to a firmer footing in order to sustain the work over time – this is in part why we stress the need to become a member wherein the facilitator acquires competencies and establishes themselves as a sustained presence in the setting.

What one might call the 'compulsions of proximity' are central to this process in that the facilitator is there when troubles arise and is accountable for these: offering advice, a temporal sense within the project and possible remedies in that time-span as well as being able to offer fixes and workarounds offsetting the risks of working with the technology. Such practical actions can be read as tokens of commitment and are central to the endeavour as well as to the reciprocity of co-realisation's work. Obversely, the facilitator's presence is a tacit reminder to the participants of their undertaking to take part in the work of co-realisation. Thus, not using the technology becomes an accountable matter – the obligation is to use the system or to explain why this cannot be done at present (e.g., "you can't do that, the facilitator is here")[2]. Yet obliging through presence alone is not a sufficient predicate for the work – members have to find the system work affording in and as a part of that use to continue using the system. Members also have to trust that the system is approaching work affording and that progress to this goal will take some time – in other words, time and commitment are required to make co-realisation work.

After roughly a year of use, it was jointly decided that speech recognition was not going to be a viable means of producing letters. This was done without rancour; there was neither feeling that time had been wasted nor that the attempt had not been worthwhile. Rather, it was decided to pursue the goals that speech recognition aimed for by different means – through the production of a discharge summary from an electronic medical record that had been under development as part of the same project.

The process of co-realisation enabled the putative users of technologies to become aware of the ways in which technologies could be configured and reconfigured to afford their work. The facilitator's role included the co-realisation of an evolving solution in and as a part of work-affording technology. A central tenet of this is that it is vital that users can say what it is they do not want as well as what they do. In co-realisation, users can experiment in a relatively risk free environment and explore the technologies without feeling that they are being 'sold' or 'manoeuvred' into a solution too early. Yet, to give new technologies a 'real chance', there has to be commitment and we would point to the role of co-realisation in actuating it: that is to say, users and 'facilitator' as a team become committed to an experimental process of change that allows new technologies to 'settle' into an evolving working culture.

Making the system available to the user involves the crossing of what have traditionally been conceptualised as boundaries between the technical and non-technical: it is our contention that this boundary is a problematic construction and that when we speak of co-realisation we have to treat these boundaries as being produced as a retrospective rationalisation. In practice, while boundaries between technology production and use are continuously crossed, users usually receive very little support for their bricolage work of making 'the system' work. In contrast, co-realisation foregrounds the work of bricolage and distributes the responsibilities more evenly. The system becomes everyone's concern, the point being to use it to afford work practice as opposed to demarcating were one stands in the organisation of technology production and use. New technologies are not 'slotted' into a dynamic and complex socio-technical system, but 'grafted' into its substrate, becoming a part of its dynamic – in positive, but also potentially negative ways. Co-realisation is a way of acknowledging the risks and costs of this process. The process of realisation is two-way: the facilitator is able to show how to use the system while the members, having this support, are able to envisage more fully ways to integrate it into their everyday work tasks.

The opportunity to play with technologies and to examine their potentialities is at the heart of co-realisation. Co-realisation invokes the imagination of all participants whilst

[2] While this was said humorously, its sense does play off the obligations engendered in co-realisation.

tying the technology to its workplace use. When one examines the ways that members engage with the technology, one finds that they look at it in terms of how it affords their work and how it might be used in the work setting in a contexted manner – such situated experiments are the result of co-realisation making a space for them and it is important that co-realisation is able to make such a space.

MAKING IT HAPPEN

The next example is drawn from a co-realisation project that involved a small research group (ethnographers and computer scientists) and a practice of landscape architects, one of eight branches in a larger company, based in the northwest of England. We will focus on the 'bare bones' of the natural history of participation here to illustrate further points within our argument. More detail can be found in [11].

When the project started in October 1995, almost all the production of 'output' – to clients but also to professional partners and contractors -- was paper based. Coloured maps, photomontages, sketches, master plans, and construction drawings were all drawn on paper and photocopied. Exceptions to this were text processing and intermediate steps in creating the drawings and maps: contour maps and wirelines were both created in AutoCAD and plotted on transparent sheets for use as layers in the construction of maps and drawings. This was our starting point for a collectively organised process of change.

Less than a year later, all workplaces were equipped with PCs that were networked internally and had access to the Internet through a gateway. A substantial part of graphical work (photomontages, drawings, master plans, etc.) was produced digitally (some of it using pressure sensitive tablets and pens), and communication internally as well as to external partners was increasingly facilitated through email and attached files. While this project also mainly used off-the-shelf components at relatively modest cost, the relatively small scale and bounded nature of the practice as an independent unit allowed us to carry through a significant transformation into an integrated system of technical support.

The way of working in the project was one that involved a meeting between different competencies: ethnography, technical computer science, PD and various competencies within landscape architecture. The mode of cooperation was therefore not so much concentrated around established PD techniques such as prototyping sessions, workshops, organisational games and the like. Rather, it was characterised by a continuing presence (on average, something like one day a week in the case of the IT facilitator, and more variable periods for the workplace analysts) in which the effort shifted fairly smoothly between implementing or adjusting previously decided possibilities, picking up on the host of small problems that arise during work, coping with the unanticipated consequences of previous actions, talking to individuals, and occasionally setting up larger meetings for important decisions.

As with the healthcare project, this project was an explicit attempt to engage in a process of co-realisation and judged on this basis it was successful. Even though the landscape architecture practice in question was facing major financial difficulties [12], due to a successful build up of trust and commitment, radical changes in the work practices were successfully accomplished.

There were several factors contributing to this. Probably the most important one was the readiness of all parties to take on (or to be urged into) various roles. So far, we have described the members of the co-realisation team as IT facilitators, practitioners, work analysts and ethnographers. However, on closer inspection, a more diverse set of roles emerges – for all members of the team. The development process can metaphorically be regarded as a journey, with the domain expert 'standing in front' proposing which way to go, the facilitator 'standing beside' assisting in the exploration of current conditions and possibilities; and others urging people onward. Within PD, the role of the facilitator is often considered to be the ideal one, among other reasons due to its (apparent) neutrality, and because the other roles introduce the risk of 'knowing better', 'taking sides', etc. However, it is very often the other two roles that facilitate trust and commitment (assuming the 'expert' turns out to be correct and the 'goad' is willing to facilitate). These are the moments where people 'stick their necks out', take on responsibility, and run some risks. In the landscape architecture project, all parties were willing to take on (or to be urged into) the various roles and to shift between them readily, thereby creating an environment in which everyone took on responsibilities and risks, and contributed to the overall project.

As with the healthcare project, a related factor was the willingness among the participants to cross boundaries between research and doing landscape architecture; between designing new solutions and understanding current practices; between technology as an object of study and technology used for a purpose; etc. For an outside observer, it would have been difficult, for example, to judge whether the researchers were participating in the analysis and re-design of work practices in the branch, or if it was the landscape architects participating in a research project. In effect, it meant that most participants, although to varying degrees, felt committed to all the various objectives and agendas within the project.

A third factor is the acceptance by the two main parties (researchers and landscape architects) that they had diverse objectives and agendas, and that those were, for the most part, explicitly formulated. As it turned out, this resulted in the requirement for almost all the activities that were taken on that they should fulfil both long-term objectives and short-term gains. It was, for example, not enough to buy a printer and produce drawings digitally. Because the long-term research interest lay with the creation of a new working culture that integrated new technologies, electronic communication (email and internet) was also required, even though there was (in 1995) no immediate need for it from the landscape architects' point of view. Although, at the time, this was sometimes seen as a constraint, there is no doubt that it helped considerably in maintaining commitment among the participants.

In both the healthcare and landscape projects, the participants could be said to be accepting the compulsions of proximity. The aim of co-realising a work affording new state of the socio-technical system requires something close to genuine consensus from members of very different communities. Practitioners, work analysts, and IT facilitators come together and agree to engage with each other as equal partners with different areas of expertise that need to be woven together, not just 'patched'. This often brings intense, at times uncomfortable, proximity. Each member needs to commit to trying to explain their perspective, defend it when necessary (i.e., not be shy of conflict), and show a genuine willingness to engage with the problem from the others' perspectives even if there is disagreement. This makes collaboration very rewarding, but at times also very demanding and difficult. The continuing engagement can not simply dissolve differences of interest and perspective, but means that they must be faced and acknowledged, and that accommodations need to be negotiated – there is nowhere to hide.

PARTICIPATION AS A DAY-TO-DAY ACHIEVEMENT

The next example is from a project set in a manufacturing plant producing mass-customised diesel engines (EngineCo). The setting is interesting in that there are IT staff located at the site of use of the system they built and now maintain, the central assembly control host that controls the overall operation of the plant [1]. Ongoing development of products, the plant, related IT systems and working practices is very much part of the daily working life of various kinds of IT staff and production worker. While these practices are not explicitly informed by the PD tradition, users are still involved in systems development at a number of levels and the boundaries between design, development and use are, to a certain extent, permeable. This illustrates how doing participation is not simply to be treated as a bounded matter, but as a way of working that is predominantly a practical engagement with the workplace and its design issues. Co-realisation is, then, situated in and as part of ordinary, naturally occurring work: doing whatever the organisation is concerned with. There is no time out from co-realisation, and this study shows how 'naturally occurring' participation in such activities can occur even in the absence of an explicit participatory agenda. We show how risk, responsibility and trust cut across boundaries in the 'doing' of IT.

Material Flow and Its Troubles

Material is supplied to the plant by roll-on/roll-off trucks that deliver material directly to conveyor belts in the goods entrance part of the plant. Infrared-guided autonomous carriers transport boxes of material to their destinations. Most parts are delivered to shelves distributed throughout the plant but there is a certain class of parts (especially crankcases) which are delivered to a small number of material storage towers (MSTs) that have recently been installed as part of an ongoing effort to improve the material flow.

One of the MSTs is located close to the goods entrance, so all carriers have to pass through the area in front of it. The combined traffic of carriers supplying crankcases to the MST and of carriers moving to other locations makes the area a 'hot-spot' where problems quickly accumulate. There is an ongoing discussion of this problematic situation that is itself part of the larger discourse on the ongoing evolution of the plant that people engage in, in and as part of their everyday working practices.

In the past, conveyor belts in the goods entrance were emptied one by one so that if a truckload of crankcases were delivered, all subsequent transports would be between the goods entrance and the material storage tower in question. This would cause too much traffic in front of this MST with a significant number of carriers being idle waiting for other carriers to unload and get out of the way. This led to the idea to mix different kinds of parts that have different destinations so that only some part of the transports would go to the MST, relieving the 'traffic situation' in front of it. This would improve the utilisation of carriers since fewer carriers would sit idle awaiting access to the tower. A side effect, however, is that the average time before a conveyor belt is completely emptied (and thus made accessible again for further deliveries) is increased.

The basic idea of mixing material is a very simple one and it was implemented by on-site IT staff in a relatively straightforward way by modifying the programming of the computer controlling the goods entrance. However, this has a number of implications that are far-reaching and in order for it to be effective, a number of factors have to come together so that the desired effect is achieved in practice. This involves the work of a number of plant workers, not least those in the control room. So, quite naturally, they are involved in bringing about the desired effects, turning the idea, the candidate solution into a working solution in context. We find that they also participate in a number of ways in the discussion of this change and that their participation is taken for granted by some, anticipated, and even demanded by others. The question of participation in this context is not so much 'if', but 'how'.

It is important to note that a change is not seen as necessarily being final and finished, but rather as a trial. It is difficult in such complex contexts to establish *a-priori* what the effects will be and even after the change is implemented, judgments of effectiveness and efficiency are contested. Control room workers take part in the discussions about changes in the plant, they are aware of the context in which these discussions take place and can refer to the history of previous interactions, to what we might call the *biography* of the plant. Participation is not unproblematic and is subject to many contingencies as illustrated below.

Demonstrating Competence

Control room workers regularly formulate alternative solutions and thus contribute directly to the shaping of their work context. In this example, workers suggested that the desired effect of relieving the traffic situation in the problem area could be achieved with means that were readily available and under control room workers' control, namely assigning different priorities. They intended to demonstrate the effectiveness of this alternative strategy but were unable to do so because that state of production in the plant didn't allow them to. Demonstrating that a candidate solution works in practice, of course, is the strongest argument in an engineering culture but the demonstration has to be made in terms of 'hard data', i.e., a change in performance has to be recorded in terms of some accepted measurement. This measurement then has to be defended against possible criticism. Clearly, a truck waiting outside the plant is more expensive than a couple of autonomous carriers waiting inside, but it has to be demonstrated that there was a need to order the delivery in the first place.

Participation is thus subject to challenges and one has to be seen as a member in order to be successful. Being a member is an achievement that is established through repeated interactions and also one which has to be actively defended. Control room workers have at their disposal various means that help them to maintain their position as knowledgeable members; they have the widest range of data available to support their arguments. On the other hand, they do not normally have the time to perform thorough investigations and to work up convincing presentations. It is sometimes quite easy for them to make their point in the control room where they have immediate access to the systems, while making the same point in meetings is much more difficult. Members improvise by, e.g., printing off screenshots of production control systems to strengthen their position in discussions taking place outside the control room. Repeated screenshots enable them to refer to a history of events in the plant. This history, of course, is only a partial representation of the events in the plant and other parties may challenge the conclusions drawn from this representation.

Since the effectiveness of a change like the mixing of material is contested and because there are bound to be situations when the measures are actually counter-productive, ways have to be established to influence the way the control system works. At present, the only way to do this is to change the control system program, which is both costly and risky to do. So control room workers are trying to influence the design of the next version to have a selection mechanism built into the system.

From the 'Meckerbuch'

Control room workers use a Word document to trace issues with the assembly control host system. This document is referred to as the 'Meckerbuch' (complaint book) as it records the issues that control room workers have raised in their interactions with IT staff. It is also a means for tracing these issues and to control the process of them being discussed and resolved in some way. We might say that it provides a natural history of the interactions that go on in and around the project and that its 'traces' are the history of co-realisation within the system.

1. Engines are "red" even when only loose material is missing.
2. Engines are downloaded "green" and then turn "red".
3. Engines do not turn "green" if there's first an FA-part [flowing assembly] and an LM [loose material] missing but later there's only the LM missing.
Mr Peters + KO # occurred again on 09.04.
Mr McLean # no explanation
27.07. can't be reconstructed

In this example, the problem statement leads to a sequence of efforts aimed at specifying and resolving the problem. There is no established way of doing this, so people have to live with its consequences. Since the nature of the underlying problem is not known, a number of actors engage in activities such as tracing and recording occurrences of the problem and referring to the system structure to unveil the causes of this problem. The problem is not resolved, however, but since occurrences are infrequent and consequences low, the case is nevertheless closed for the moment. It might, of course, be reopened, should the problem reoccur and be more severe or should new information become available. The entry serves as a record to refer back to the previous occurrences of the problem and to identify the workers who were involved in trying to resolve it.

Reason for blocking A-boxes is not accepted.
30.01 Mr Peters # today not IO # expected 27.02.
done 27.02.

The second example shows how the Meckerbuch is used as a means for tracing the work of IT staff. There are not normally formal meetings between IT staff and control room workers as the latter work on shifts and do not normally leave the control room for long periods of time. Instead, interactions take place as opportunities arise. Some IT staff regularly visit the control room and control room workers often ask IT staff to come around to look at or discuss problems. It is difficult to draw any clear distinction between what might be called 'design' or 'use'. As both IT staff and production workers grapple with a complex ensemble of technologies, co-realisation is achieved in, and as part of, their naturally occurring interactions.

Risks are perceived and commitments made in relation to what the organisation normally does. The risk of losing data, for example, is evaluated in terms of the risk of not being able to do one's job properly rather than in terms of some abstract principle of "keeping data safe". Recently, an electronic shiftbook application was installed in the control room and workers initially agreed to cut-and-paste entries into a backup system while the stability of the new system was tested. They also printed off entries at the end of every shift. After two weeks of problem-free operation of the new system, however, they decided to no longer use the backup system. As one worker put it: "The worst that can happen is that we lose one shift worth of entries and that is easily re-established." Some weeks later one worker even suggested that there was no longer a need to routinely print the entries but the IT facilitator strongly objected, not trusting his system completely and unwilling to take the blame for potential future loss of data.

It is evident from this example that participation in the sense envisaged in classical PD is taking place in this setting, regardless that it is unlikely that many of the participants have ever heard the term. This is because there are no clear boundaries between design and use and the system is subject to near-continuous evolution. Users and IT facilitators participate as members and this membership is mutually acknowledged, but it has to be earned. It takes place sometimes through tensions, conflicts and contestations, not through avoiding them. We have shown some of the different, though not necessarily unequal, ways in which participants are resourced for these local 'struggles'. While it takes place in a commercial context, this is the internal market of the firm and so at some distance from the discipline of undiluted exchange-value.

What is more, it is far from clear that this is 'second best' to 'classical' PD. Specifically classic PD projects are obviously an exception to the standard routine of work, which generate their own excitements, energies and commitments, but which are likely to be demarcated in time, specialised in scope, and isolated from wider, everyday practice. In EngineCo, by contrast, the engagement is much more 'authentically' grounded and longitudinal. The tentacles of its co-realisation will penetrate far wider and deeper within the organisation and they will be sedimented in time. By comparison with the concentrated trust and commitment worked up in the context of a specialised project, it may be less intense and more exposed to the routine politics of the organisation, but it is 'steadier' and can also draw on the larger context of commitment to the larger undertaking of the organisation. It is, one might say, *participation in the wild*.

DESIGNS ON THE FUTURE

Our fourth example is a project that brings together IT facilitators, industrial designers, architects, landscape architects, and work analysts. As part of exploratory, long-term research, the team develops technologies aimed to become viable in 5-10 years. The work is grounded in ethnographic observations and collaboration with landscape architects, but is unusual in a PD context because its time horizon stretches out far into the future. The design approach has important continuities with the more immediate and hands-on landscape architecture bricolage project outlined above, and the co-realisation team seeks to remain true to those. However, given the 'futuristic' orientation in this project, how can one retain a bricolage element? We show below how, even in this context, carefully negotiated practical politics helps to find ways of 'grafting' new technologies into a future working culture, greatly improving the design and the 'fit' between them.

Designing Spaces

As part of the EU programme on the 'Disappearing Computer', the WorkSPACE project aims to design new kinds of (work)spaces by exploring and realising ways in which computation could be used differently. Spatial and embodied aspects of collaborative work inform a particularly important avenue of design. A collaborative virtual environment where configurations of electronic work materials can be created as part of ongoing work is a first step in this direction [5]. It is an important element of the overall design rationale but it can be greatly enhanced by creating a more ambitious hybrid mixed reality environment that exploits: advances in display technology – e.g., large screens, stereo projection, portable, and transparent displays; Indoor/outdoor sensing, tracking and tagging technologies; new forms of interaction – e.g., touch screens, pen or gesture based interaction, 3D sound and force feedback; enhanced inter-connectivity between devices; miniaturisation of devices, making them portable; and computationally augmented paper and materials increases in bandwidth and network infrastructures.

Through these technologies, mixed configurations of work materials and new ways of working with them become possible, such that computation becomes increasingly ready-to-hand and thus 'invisible' [3,4] within a hybrid digital-physical environment. These ideas have been worked up in the context of PD cooperation with different groups of landscape architects and are now being further refined and realised in a new round of continuous and close collaboration with these professionals.

Snapshots

At the start of the project, a group of landscape architects who had had no involvement in the initial formulation of the design rationale became part of the team. Their immediate and enthusiastic grasp of the ideas is evidence of the relevance and appropriateness of the project's aims and marks an important point within the 'natural history' of participation in a 'futuristic' PD project.

As the architects are being introduced to the Topos virtual workspace, they see how one might gauge information about activities in remote collaborators' workspaces. They like it:

> "… there's huge amounts of functional applications … what's interesting is where using it [Topos] would take us in projects that we want to bid for … in terms of the commerciality and competitiveness of what we do …"

Two aspects of the landscape architects' motivations and expectations are particularly striking here: (1) They expect to be able to use the software immediately in the context of real work. (2) They expect commercial and competitive advantages. The statement above refers to the possibility of mentioning Topos in bids for projects - a cutting edge technology that can double up as a signifier for competence in information management. Their enthusiasm is very welcome. It suggests that it might be possible to observe the emergence of a new working culture *in vivo*. Using a technology that is still under development and unlikely to become completely viable within the space of the project under real work conditions would be an invaluable design resource for the creation of a more ambitious hybrid mixed reality space. However, the realities of working life soon catch up with these hopes and put them on a more realistic footing. In the light of daily deadline pressures, the unfinished nature of 'futuristic' prototypes can be an obstacle that is hard to overcome, as the following observations from after a design workshop illustrate.

Mike (M), a visualisation specialist responsible for photomontages and GIS visualisations tries to use Topos to organise his work. He inserts an Adobe Illustrator version of a map created using a Geographical Information System (GIS) into a Topos workspace and some further files. The latter show as empty boxes and, on double-click, which usually opens the document, nothing happens. The IT facilitator (P) comments on the problem:

P: it's just an empty box.

M: it doesn't have the filename? It won't do anything with it at all?

P: no because what should we do? There's nothing to display - we can link to it but we can't do anything with it.

Mike is trying to organise source files that feed into GIS visualisations, but have no independent existence. Normally Topos displays work materials and - on request - displays them in their respective application. However, this does not make sense here, because the source files cannot be opened independently. Initially this experiment comes to be seen as indicating unsuitable design avenues. Mike suggests that "maybe it's not the point, maybe it's just not what Topos is about". But the work analyst and the facilitator persevere and try to determine in more detail how the work is done. It turns out that often several versions of a map have to be constructed, with different source files. This requires Mike to maintain an overview over which source files have been used when, in case he needs to go back to an earlier version of a map. If these relationships were intelligible from the organisation of files within Topos workspaces, it would help greatly. Eventually, the discussion sparks a design idea – to allow access from within Topos to the 'containing folder' within the Windows Explorer file manager. Mike decides to postpone his day-to-day use of Topos until this is implemented. However, it takes several weeks to do so and by the time the change is announced Mike's workload does not allow for a focused engagement with the prototype.

These two examples illustrate promises, premises, and risks inherent in new technologies, and show how they call for trust, commitment and creativity. We see both an enthusiastic endorsement of technological potential and the practical difficulties in bringing it about. Mike's engagement with the prototype generates important design insights. But it also makes its incompleteness visible. This is one amongst several factors that tighten the rope for the balancing act of PD in 'futuristic', exploratory design.

Against the odds

We have encountered many difficulties like these in maintaining trust, commitment and creative enthusiasm for the technologies and new ways of working we are designing, First, incompleteness does not only refer to individual prototypes. These are components within a hybrid mixed reality environment that will only reveal their full potential if considered/experienced in relation to a whole set of as yet 'missing links'. More intuitive ways of interacting with electronic work materials, for example, rely upon currently expensive and fragile technologies. This makes it difficult to approximate authentic use to provide indispensable inspiration and evaluation of design ideas. 'Futuristic' PD requires not just a willingness to invest time and money, a critical and creative eye, and a good level of tolerance and patience for sub-optimalities, but also imagination – an ability to fill in the blanks. Of course, all PD requires imagination, but in the context of far-future oriented design the opportunities to learn by doing through hands-on bricolage that usually provide a guiding line for the imagination, are severely limited. This inability to experiment realistically with new ways of working calls for quite radical imagination.

What it boils down to is that, unlike a bricolage approach based around the use of off-the-shelf technologies, bricolage as a design approach for exploratory research cannot rely upon the ability to fit new technologies into (changing) work practices easily. Imagination and a huge amount of work is required to even approximate suitable conditions. Who is to carry out this work? Whilst it is possible for IT facilitators to take on a large part of the work required to fit off-the-shelf technologies into work settings, the demands on IT facilitators in a more design-oriented context make this difficult. Still, to us a bricolage approach that aims to insert new technologies into work practice to explore and play with possibilities is desirable because it alone allows us to learn what we need to know about emerging new work practices to take the design further. So, how do we respond to these challenges? Some answers can be found in the composition of the team, others lie in the activities we undertake.

The co-realisation team builds upon the competencies within the user organisation more strongly than traditional PD. There are several people, including a landscape architect with IT management training and a computer scientist, who can act as technically-oriented bricoleurs. We consciously introduce a compulsion of proximity through regular online meetings that utilise some of the technologies we have realised. In addition, we simulate a future new working culture in laboratory-based workshops. The lab provides a prototype hybrid mixed reality environment where our own prototypes mix with versions of 'missing links' that are too experimental and expensive to introduce into the landscape architects' studio. The workshops combine the functions of testing prototypes and scenarios, and of driving, maintaining and illustrating the larger vision and its enthusiasms. These activities foster membership that goes both ways – from IT design to work practice and from work practice to IT design. It helps greatly, too, that our collaborators are themselves designers who are used to the drawn out and hesitant ways in which aesthetic and practical visions are realised over time.

In this setting, a 'complete' bricolage of new prototypes and newly evolving work practices is unattainable. We are creating future forms of technology that will not become completely viable within the scope of the project. The gap between existing conditions and our vision can only be closed through imagination and improvisation. However, this introduces fertile friction rather than simply a hurdle that must be overcome. Imagination-led bricolage is not second best. The fact that it is not possible to create wholly authentic experience forces us, but also allows us, to transcend the present.

Despite these potential advantages, however, it remains the case that several of the success and sustainability factors identified in the earlier examples are absent here and, metaphorically, the 'values in the cells of the pay-off matrix' systematically favour the long-term perspective of the researcher rather than the shorter-term perspective of the practitioner. It is not at all that the architects are hostile to an ambitious experiment, quite the contrary: rather, that the dull compulsions of everyday work are corrosive for commitment. Inevitably, then, this imposes a greater strain on the local politics of commitment, trust and the sharing of risk. This produces a corresponding shift in the 'mechanisms' of trust, with less reliance on achieved and embedded work programmes, and more reliance on the users' willingness to become involved in co-realisation projects, mixed with tokens, enactments and signals of the IT facilitators' membership in work practice that have an element of 'staging'.

CONCLUSIONS

The promise of participatory design is the delivery of work-affording artifacts: we have shown some of its premises and some of the sites in which we have attempted to use co-realisation methods, as well as their attendant risks and the results. Our studies, each using its own situationally grounded version of co-realisation, have shown how risk, trust and commitment might be respectively offset, worked up and sustained. We have demonstrated how, despite these projects having different temporal horizons, all find distinctive solutions in co-realisation.

A number of common threads connect the projects we have discussed. The first of these is the concern with membership – in each of the projects, what it is to do design in that setting turns on the notion of membership and its accompanying competencies. By attending to membership, the project team is able to work across boundaries of production and use [13]. It does not see crossing boundaries as inevitably signalling problems, but as offering the opportunity to create work-affording artifacts. Membership involves a common set of concerns and competencies that can be embodied in the artefact, thereby securing at least a minimal commitment to make that artifact work. Membership allows one to make competent interventions in the natural history of an artifact; through mobilising what one knows and uses, it allows one to build systems that can support the work for which they have been designed. We would argue that only through membership could one appreciate what needs to be built and appreciate what is built. In other words, membership sensitises one to the workplace and the artifacts that are designed to be used in it. The participants become, to a limited but adequate extent, members of each other's communities of practice; and all become members of a 'third space', which is a conjoined community of practice of the design project itself.

Hence the second thread is that of making a space for co-realisation: the projects' timescales vary from the 'here and now' to the future, yet there is a common concern to make a space for imagining what candidate solutions to a problem or work setting might be or over how long they might be delivered. Such spaces for imagination are important because, while one might have a number of potentially contrary imaginations, the friction therein is productive and is, as we have demonstrated, generative of work-affording artifacts. While participants accept the compulsions of proximity of this space, they are confronted with each other's perspectives and pressed to negotiate an accommodation with them. This means being led not by some process-oriented or top down change agenda, but by the ways that those doing the work want to design that work and artifacts that afford it. In this sense there is a planful vagueness in the design situation – what comes out may not be what was envisaged; what will happen is that people will be given a site in which to imagine. The conceptual 'elbow room' of co-realisation affords reflection and reflection informs design. Co-realisation opens up this space. When we take on the work of co-realisation, we take on a commitment – especially in that we take on this commitment over time – and it is this that leads us to trust those involved, and to be trusted in turn. Of course it should be kept in mind that this project space is often fragile and subject to a universe of competing commitments both within and after the project itself. Part of the work of co-realisation is to keep this space open and to keep communication and commitment flowing therein.

A third thread, then, is the willingness to make the project work – this involves the 'bracketing off' of problems in the purely technical sphere and the willingness to engage with the technology in context. All of the projects discussed above show how members are both able and willing to do this, thereby evincing a commitment to what an evolving technology might amount to, not just now – when it does not work – but later, as it becomes something that will afford work. This includes notions such as improvisation and, perhaps most important of all, patience. Finally, in all the above, there is an apparent willingness to share the risk of technical innovations and to engage with what is available, not as a provider of 'bells and whistles' but as something that will afford work, either now or in the future.

As well as these common threads, however, there are also divergences. PD can claim a head start over other methods in engendering commitment, creativity, effort, trust and the sharing of risks and responsibilities, but the settings in which it seeks to do so vary, and some are more propitious than others. For example, we saw that short timescale, off-the-shelf components, limited cost, and the presence of the facilitators made it *relatively* straightforward for the parties to exercise reciprocity in the work and to perform the various tokens, enactments and signals of respect and consideration needed to keep co-realisation moving along. This could be sustained both for a relatively isolated technology (healthcare) and for an integrated small-scale work environment (landscape architecture).

In the EngineCo example, however, we saw that these achievements can be realised very effectively in a setting which does not conceive of itself as a PD project (or, indeed, as any kind of project) at all. This was despite the high complexity of the work, technology, hardware and software setting. While it is surely helpful to set one's actions in a participatory frame, it is probably nothing like as helpful as this kind of 'natural' and sedimented evolution of commitment and creativity, and the naturally-occurring local politics of trust.

In the WorkSPACE example, we saw that the long term and experimental character of the developments creates opportunities and rewards but also hazards for a PD approach. An important characteristic here are the demands placed on the users to become members in a design team, to imagine a new working culture 'through' an incomplete ensemble of working prototypes, fragile and expensive new technologies, and still missing links. This produced a shift in the local politics of trust and commitment and in the mechanisms brought into play to cope with them towards laboratory based activities, imagination and somewhat formalised and periodical rather than continuous engagement of facilitator's in work programmes 'on the ground' at the workplace.

In the course of all the projects, the promises, premises and risks of designing new technologies became re-defined, as did the boundaries between technology production and use. All the examples presented in this paper provide insight into different ways of breaking down the boundaries that otherwise impact upon sharing responsibilities, working up trust and sustaining commitment.

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WORK IN PROGRESS

Human-Centered Public Transportation Systems for Persons with Cognitive Disabilities — Challenges and Insights for Participatory Design

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ABSTRACT
In this paper, we present a participatory process for designing new socio-technical architectures to afford persons with cognitive disabilities the opportunity to use mainstream public transportation systems. This project faces two unique challenges: (1) there are no true "experts" who understand all facets of public transportation system design, operation, and maintenance; and (2) each person with cognitive disabilities represents a "universe of one," preventing the technology designer from thinking in terms of typical "user classes." Participatory "in-the-world" design is therefore a necessary and critical facet of this research, and the design process must include members from diverse communities. Our design team participants include assistive care specialists and family support organizations, urban transportation planners and managers, hardware and information technology designers, and university researchers. Designing for a diverse user population or a complex system acts as a "forcing function" for using a participatory approach, and it is simply impossible to create a good design without it. This paper will highlight insights from this process that have illuminated our research efforts.

Keywords
participatory design, transportation systems, technologies for persons with cognitive disabilities, caregivers, "universe-of-one," personalization, universal design

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INTRODUCTION
Public transportation systems are among the most ubiquitous and complex large-scale systems found in modern society. In many urban cities, public transportation systems are broadly accepted as the preferred transportation alternative for commuting to work, performing errands, or traveling to social events. But for certain members of society, including persons with cognitive disabilities, the elderly, and the unfamiliar or out-of-town visitor, these systems can be complex and daunting to learn or use. For those with cognitive disabilities and the elderly, the freedom to live independently, socialize, or hold a steady job is tightly coupled with their ability to use these complex systems. Because of shortcomings in current systems, fleets of "special access" vehicles are often dedicated to supplement mainstream systems. While sound in intention, these special vehicles also separate users from mainstream experiences and require advanced reservations, thus preventing flexible ad hoc travel.

PROJECT GOALS
The objectives of our "Mobility for All" research are:

- **Analyze and understand the cognitive barriers in public transportation systems**. Using a participatory design approach [Schuler & Namioka, 1993], public transportation systems will be surveyed to develop a conceptual understanding of the cognitive barriers that exist and must be addressed in current systems. The survey will include field studies to observe occupational therapists and assistive technology specialists as they train persons with cognitive disabilities to use these complex systems. The survey will also explore emerging transportation and information technologies to inform our understanding about infrastructures that could be adapted or leveraged within a near-term time frame.

- **Design a "Mobility for All" socio-technical architecture to reduce cognitive loads in current public transportation systems**. In collaboration with technical experts and support communities, a technical architecture will be designed that addresses the functional needs of transportation users and caregivers, while providing technologies necessary for a reliable, safe, and trustworthy system.
- **Implement and evaluate socio-technical prototypes within a "real world" setting.** In collaboration with public transportation managers, designers, and caregiver communities, technical prototypes will be developed, assessed, and refined within our local university and city transportation systems.

DESIGN PARTICIPANTS

To achieve our project goals, we have assembled a unique consortium of expertise from university, local government, public education, and commercial sectors:

- **University researchers** from the following institutions:
  - **Center for LifeLong Learning and Design** (L^3D; http://www.cs.colorado.edu/~l3d/) a multi-disciplinary research center at the University of Colorado that studies the design of intelligent systems that serve as amplifiers of human capabilities.
  - **Cognitive Levers Research Project** (CLever; http://www.cs.colorado.edu/~l3d/clever/) an L^3D research initiative to develop computationally enhanced environments to assist people with a wide range of cognitive disabilities.
  - **Coleman Institute for Cognitive Disabilities**, a privately endowed research institute at the University of Colorado founded to develop information technologies that address challenges faced by persons with cognitive disabilities and their families.
  - **University of Colorado/BP Center for Visualization**, a unique 3D immersive simulation center for virtual design, test, and evaluation.
- **Assistive technology specialists** from the Boulder County public school district (working part-time in the L^3D Center), and the University of Colorado Assistive Technology Partners (http://www.uchsc.edu/atp/).
- **Transportation system planners, managers, and operators** from the City of Boulder and University of Colorado.
- **Technology developers** including **AgentSheets, Inc.** (http://www.agentsheets.com), a software company formed from an L3D research initiative that develops agent-oriented programming environments; **BEA Inc.** (http://www.bea.com), a software company that provides web infrastructure substrates for enterprise application development and personalization; and **Intuicom** (http://www.intuicom.com), a local developer of high-precision Global Position Satellite (GPS) and mobile communications technologies.
- **Urban planners and designers** from the City of Boulder; and Communication Arts (http://www.commarts-boulder.com/), a Boulder commercial design firm responsible for several award-winning international urban and public transportation system designs.

Each participant brings a unique role and perspective into the project, but all are united by a desire to design future systems that are inclusive and universally accessible for all of society.

METHODOLOGY

Our team has used the methodology seen in Figure 1 to study existing transportation systems.

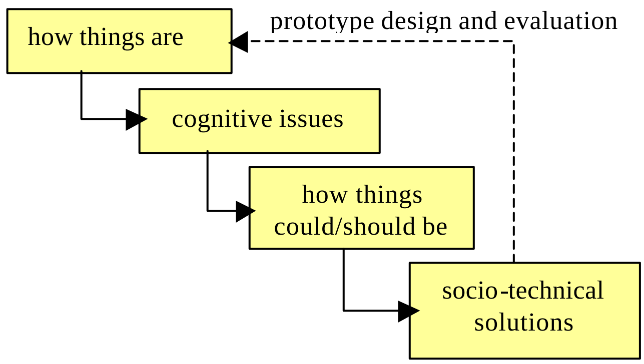

Figure 1: Research methodology

Our assessment of "how things are" began with an analysis of current transportation systems, assistive approaches for learning these systems, and a survey of emerging transportation system technologies. Once real world constraints and cognitive issues were identified, our team developed scenarios and architectures to illustrate "how things could be" and provide a framework for the design of socio-technical prototypes [Ehn, 1989]. Within this methodological context, we will summarize results from our field studies and present some preliminary socio-technical prototypes.

FIELD STUDIES

Our team conducted field surveys of public transportation systems (bus, light rail, and subway) in five major cities including Denver, Milwaukee, Chicago, Washington DC, and Tokyo. Our team has also studied a "next generation" bus system in Vail, Colorado and observed high school students with cognitive disabilities learning to use public bus systems in Ft. Collins, Colorado.

We will now summarize our major findings.

Finding #1: Non-impaired users generally fall into one of two categories:

- **familiar users**: regular commuters who routinely use public transportation systems on one or more routes.
- **unfamiliar users**: infrequent users, out-of-town visitors, or familiar users attempting to learn a new route.

Finding #2: When using public transportation systems, unimpaired users engage in a series of high-level activities that include planning, waiting, and moving. These high level activities can be further decomposed into atomic cognitive steps of: *"reflect®choose®act"* [Schön, 1983]:

For example while waiting, users reflect on where they are in the journey, what connection (bus, train, etc.) they are waiting for, how to identify and select the correct vehicle, and finally where to move and board. In other words, every step – including the appearance of "doing nothing" – imposes cognitive loads.

Finding #3: To use public transportation, it is necessary comprehend, manipulate, and process "*essential navigation artifacts*" [Tufte, 1990]. These artifacts include:

- *maps:* needed to determine one's current location, destination, routing options, and overall trip progress.
- *schedules:* necessary to find a feasible transportation route at a particular time of the day or week.
- *labels and signs:* to identify where to go, which transportation vehicle to take, where to get on and off.
- *landmarks:* to confirm progress and identify locations.
- *clocks:* to synchronize schedules with arriving transportation vehicles.

Finding #4: Even "familiar users" make mistakes when using public transportation systems. Mistakes are caused by [Norman, 1988]:

- *system errors:* mislabeled buses; buses not running on schedule, or taking a "detour" from the normal route;
- *user errors:* falling asleep, failing to hear or understand the announcement of an upcoming stop, forgetting to signal intentions to get off at the next stop, getting on the wrong bus, or getting off at the wrong stop.

Unfortunately, our survey did not reveal any transportation systems with fail-safe systems designed to help a user detect or recover from these unexpected errors. When familiar users discovered they had made an error, they often acted like "unfamiliar users" and needed to use *essential navigation artifacts* get back on track.

Implications for persons with cognitive disabilities using public transportation systems.

These field surveys identified cognitive issues facing persons *without cognitive disabilities*. Our analysis of these findings with assistive care professionals led to the following research hypotheses:

- Using public transportation systems involves many subtle complexities. Navigation is a complex and difficult executive function [Kintsch, 1998].
- Cognitively disabled persons face many of the same problems as unfamiliar users (out of town visitors or non-native speakers) who are learning a new system or route [Newell & Gregor, 1997].
- Complex procedural knowledge is also necessary when using the *essential navigation artifacts* found in modern public transportation systems.
- Perturbations (i.e., a detour) or "system errors" require users to (1) recognize the situation and (2) engage in new planning activities. For those with cognitive disabilities, unforeseen events can prevent them from using previously "mastered" routes.
- Common user errors could likewise present significant issues for those with memory or attention deficits.
- If a memory or attention deficit is severe enough, the act of learning a new route may interfere with previously learned routes.

Problems in Transportation Systems for People with Cognitive Disabilities.

Our research team also visited Poudre High School in Fort Collins, Colorado to observe students with cognitive disabilities learning to use public transportation systems. We have also interviewed transition specialists who help people with cognitive disabilities in the "school-to-work" transition.

Key findings from these surveys include:

- Instructors engaged students in the same high-level activities observed with our study of unfamiliar users: planning, waiting, and moving.
- In the classroom, students were introduced to simplified maps and schedules. The instructor discussed the connection between bus schedules and clocks, but it was unclear how many students grasped this abstract concept.
- Once on the street, labels and landmarks were highlighted. Tremendous concentration was needed to understand these *essential navigation artifacts* and only one of eight students demonstrated an ability to track trip progress using a simplified map while traveling.
- Navigation lessons were interleaved with other essential life skills such as social etiquette. These skills are also needed for a student to safely use public transportation, but it creates problems with focus on navigational tasks.

- The ability to successfully use public transportation impacts one's ability to live and work independently. One experienced instructor reflected that approximately one-half of the adolescents in the program eventually learn to use public transportation for routine travel.

PROTOTYPE DEVELOPMENT

From our field research, two major design approaches emerged:

1. design technologies that simplify and contextualize the complex navigational artifacts encountered in public transportation systems; or
2. design technologies that transcend existing navigational artifacts and provide personalized, location-aware, "just-in-time" instructions and prompts for what to do and where to go next.

Our field research showed that current assistive training methods closely approximate the first design approach. For example, assistive teachers often used "analog technologies," such as simple user-colored maps and schedules, to serve as memory aids for their students.

Despite using these simpler artifacts, our field research also showed that (1) there was limited success for those unable to master higher level navigational concepts, and (2) a significant amount of individual training and "confederate tracking" [Newbigging, 1996] (using an unknown instructor follow a person who is traveling alone) is necessary before a person is considered capable of using public transportation without assistance.

Our team has therefore focused on the second design approach – creating technologies that eliminate the need to master complex navigational artifacts. To reduce the burden on caregivers, our team has also considered how technologies could be designed to help privileged individuals (such as caregivers or family members) monitor and assist persons in their care as they learn or use a new route.

As a proof-of-concept, we have developed a technical prototype with two synchronized components (Figure 2):

- a 3D display of the University of Colorado bus system showing the real-time GPS location of all buses and a "virtual person" who responds to prompts from a simulated mobile prompting device; and
- a simulated mobile prompting device that provides personalized multi-modal (pictures, sound, voice, and/or text) "just-in-time" prompts for "what to do" based on real-time GPS bus data.

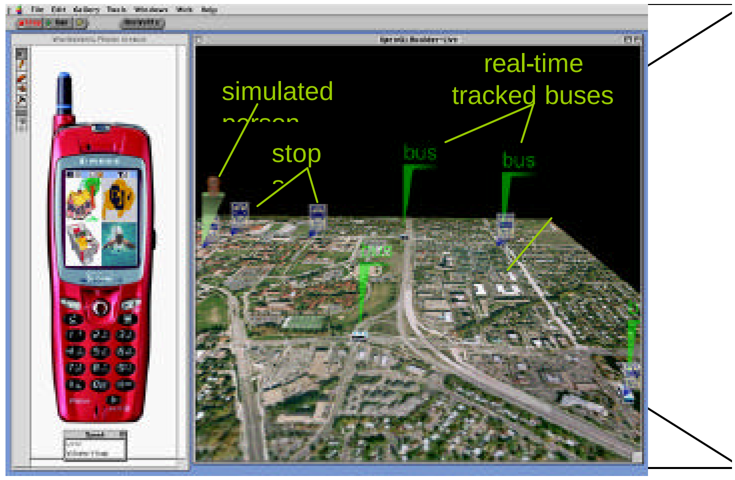

Figure 2: Agent-based prototype showing a mobile prompting device synchronized with a 3D real-time display of the University of Colorado bus system.

FUTURE WORK

This prototype provides an "object to think with" as we progress toward our goal to design a mobile platform that provides personalized, location-aware prompts and instructions. Other project plans include:

- a schedule and activity management system so caregivers can easily create personalized itineraries and offer help while people travel.
- infrastructure mechanisms to support sharing generalized itineraries and routing options among caregiver communities;
- communication-augmentation systems to support essential dialogs between persons with cognitive disabilities and transportation system operators;
- automated error detection, recovery, performance feedback, and if necessary, caregiver notification systems;
- dynamic, knowledge-based infrastructure technologies to make travel more safe, enjoyable and comfortable. For example a computational "routing agent" might facilitate a serendipitous meeting between two friends by routing them through a common bus stop on an itinerary.

IMPLICATIONS FOR PARTICIPATORY DESIGN

Designing systems for persons with cognitive disabilities in the complex domain of public transportation provides unique insights for participatory design:

- No single perspective can yield a satisfactory solution. The unique needs and abilities of our users must be juxtaposed with the complexity and constraints of modern public transportation systems, making collaborative partnerships essential [Fischer, 2000].

- Complex socio-technical systems cannot easily be studied and designed in a laboratory [Nardi, 1997]. Problems such as people falling asleep or buses not running on time are likely only to be seen in the world, and not in a lab.
- There are no "silver bullet" technologies that can replace caregivers. However, we believe socio-technical solutions can be designed to (1) provide mobility and independence options contextualized to the person and situation [Fischer, 2001]; (2) augment memory, focus attention, and offer help; (3) allow caregivers to tailor support to suit the needs and abilities of each individual; and (4) deliver prompt, personalized assistance when needed.
- Participatory design should not be viewed as an additional step or burden on existing domain practices, but a catalyst to inform, enhance, and possibly transform existing practices [CTSB, 1997].
- When designing for persons with disabilities, participatory design is not optional, but essential. What is unique and challenging about design in this domain is that another group (the assistive care community) often acts as a proxy so any new assistive approaches must ultimately be tested, assessed, and refined in-the-world with real users.

CONCLUSIONS

Understanding the needs of people with cognitive disabilities poses unique challenges for participatory design, but it has the potential to provide unique insights. The significance of our research effort is that (1) it addresses the needs of an under-represented and often non-vocal sector of society within the context of a technically complex system; (2) it requires the participation of disparate communities for a common goal; (3) it could change the methods and practices of participants, and influence the way future designers and engineers are educated; (4) it has the potential to improve public transportation systems for everyone through the adoption of universal architectures and prototypes that promote universal access.

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Improving the language of electronic dialogue in participatory projects.

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ABSTRACT

Residents affected by urban interventions and development projects have in South Africa's recent history, frequently challenged the legitimacy of development decisions. In a South African context, the process of intervention is itself often a primary factor in rediscovering social, cultural and spatial identity. A subsequent polarization between the professionals' and publics' roles is detrimental to the participatory process. Formative communication between participants, for example architects, residents and planning authorities, contributes to consensual decision-making, empowerment of residents, and a sustainable improvement of living environments. The objective of relating architectural design to context therefore invites a closer inquiry into the nature of the residents' everyday experience of their environment, that is to say the identity of place, and consequently into the nature of emerging information and communication tools used in that inquiry. This paper looks at examples of participatory projects where digital information and communication tools have been used and indicates areas of current and future research to improve the dialogue between 'experts' and 'users'.

Keywords

Community Participation, Dialogue Methods, Virtual Representation.

INTRODUCTION

Residents affected by urban interventions and development projects have in South Africa's recent history frequently challenged the legitimacy of development decisions. In a South African context, the process of intervention is itself often a primary factor in rediscovering social, cultural and spatial identity. Manuel Castells' description of 'project identity' in his analysis of social opposition may be aptly applied to this phenomenon: "when social actors, on the basis of whichever cultural materials are available to them, build a new identity that redefines their position in society and, by so doing, seek the transformation of overall social structure" [1].The need for identity through community and the importance of cultural history in building a social environment has been well established, and project identity may be interpreted as explicit attempts at creating and empowering a sense of community in participatory planning.

The relationship between expert-architect and user-resident in community-based projects is made more complex where there are many hundreds of potential participants. Participation is these situations is better approached as a democratization process - an end in itself and not simply a means to facilitate planning goals. Development is not a commodity to be delivered - interventions are made into dynamic processes that already exist. The first challenge facing the practitioner is to understand the existing process into which she or he is intervening [2]. The objective of relating architectural design to context therefore invites a closer inquiry into the nature of the residents' everyday experience of their environment, that is to say their identity of place, and consequently into the nature of emerging information and communication tools used in that inquiry.

More recently, planning authorities and professionals in urban renewal developments employ innovative information and communication technology in attempts to engage communities in decision-making. In the service of participatory development strategies, tools such as GIS, virtual prototypes, and the internet increasingly disseminate spatial and visual information to communities in widely different cultures. These materials will therefore increasingly affect project identity.

However, this paper will maintain that these tools cannot be uncritically accepted as improving participation by their use alone, and will describe areas of current and further research to improve the language of their communication.

RESISTANCE TO TECHNOLOGICAL CHANGE

Historical examples of misunderstanding between experts and users in technological innovation have been previously described by Johan Schot, among others [3]. In describing

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specific examples in Holland and England, such as the English Luddites of the early nineteenth century, Dutch stevedores' resistance to the introduction of grain elevators to Rotterdam harbor in 1905, and the expansion of Schiphol airport after 1969, Schot writes: "Willingly or unwillingly all those involved came to play the role of proponent or opponent".

The introduction of networked digital systems, while holding the potential to broaden participation in development projects, holds the danger of further polarizing the actors involved in urban planning. In Castells' analysis, computer networks do more than allow an enhanced organizing of activity and sharing of information: "they are actual producers, and distributors, of cultural codes" [1]. The notion of a 'global village' has thus been aptly described as more of a "global gated-community" in the face of a widening digital divide between rich and poor nations, and between the rich and poor inside those nations [5]. South African experience reinforces the cautionary note sounded by these and other writers. Networked communication systems convey of themselves a new dynamic; the instruments used to represent planning and design concepts shape public expectations as well as influence the environments actually produced.

In the context of this paper, it may be noted that it is one of the more problematic ironies in contemporary architecture that technological and scientific developments, in aiding the spread and globalization of consumer culture, have generally reinforced the ascendancy of image over content, while in reaction, the reductive and superficial use of historic forms as a means of expressing regional aspirations further undermine traditional expressions of spatial identity [4]. The communication of architectural and cultural identity cannot be achieved by transmitting representations through visual images and other sensory data alone. Rather, an inquiry and development of more substantial knowledge about the identity and context of place is required to form the basis for improving the communication between experts and users.

CASE STUDIES

1. Cato Manor

The area of Cato Manor is situated within the boundaries of the Durban Metropolitan area in South Africa, and is home to about 80 000 people (2001) with a future population estimated to be in the order of 170 000. It has at various times since its permanent settlement by colonial farmers in 1845, been characterized by subdivision, 'shack farming', and the forced removals of racial groups. The latter political intervention left the area largely vacant in the late apartheid era, until an orchestrated invasion by informal settlements in the early 1990s. Shortly after this event, and growing tensions between the 'squatters' and neighboring formal suburbs, the Greater Cato Manor Development Forum was established as a collaborative project in which all relevant actors were invited to contribute to the area's future development. The Cato Manor project is now the largest inner-city urban development project in post-apartheid South Africa and includes the construction of low-cost housing, schools, libraries, community halls, markets, clinics and infrastructure. The CMDA (Cato Manor Development Association) is the agency responsible for redevelopment and has secured substantial funding from the European Union, local, provincial and central government as well as other funding agencies. The CMDA seeks to focus on the "stimulation of economic development and community empowerment through interventions such as training schemes and small, micro and medium enterprise development" [6].

Nancy Odendaal, a former employee of the CMDA and currently a researcher at the University of Natal, has described a specific implementation of GIS in the re-allocation of land at Cato Manor during the initial development stages after 1996. Following legal challenges to the CMDA development plans by roughly 450 former land owners displaced by the apartheid regime, the CMDA negotiated a settlement process which was "essentially a GIS-driven planning exercise designed and implemented by the CMDA" [7]. A tabulation of the settlements negotiated with all 446 individual claimants show results heavily weighted in the CMDA's favor, with only 5.4% of total claims deemed feasible to restore. Odendaal notes that, while the use of GIS thus speeded up the settlement claims, and hence the planned development of housing and community facilities, "the conflict resolution process had become a technical process, and limited in the amount of debate generated between participant and applicant" [7]. Her subsequent interviews with land applicants indicated that there was little or none of the promised community empowerment, but that the participatory instrument used "was a formality in confirming the 'objective' truth that was reflected in the maps produced by the CMDA GIS" [7].

It may be drawn from this case study that the information tools used had a direct influence on the mediation proceedings, and hence had spatial and cultural consequences on the environment. It can be further argued that the information technology employed was in fact detrimental to the users' interests, in so far as they had a limited understanding of the information conveyed.

2. Holmbladsgade: Dialogue Research Methods

In a case study of inner city renewal (*Kvartersløft*) of the Holmbladsgade area in Copenhagen, the aim expressed by the architects was not so much to reach consensus in new proposals with residents as it was to facilitate the creation of new knowledge through a blending of the expert's and the resident's understanding; i.e. knowledge which embraced the different perspectives in professionals' and residents' views on the subject area [8]. As such it differs in its approach to the Cato Manor study above. While the latter is driven by a rational view of development and the deterministic role of technology in a participatory process, Holmbladsgade *Kvartersløft* has much to recommend greater acceptance of concepts such as a community's memory, identity and sense of spatial significance. This was primarily approached through non verbal mapping processes which gathered site specific data, and which are interesting models toward understanding differences in perception and the stimulation of debate.

One problem anticipated was the unwillingness or inability of the majority of residents to engage in the upliftment project. In this case (1997-1999) the problem is dealt with by developing methods to inform the professionals about values and problems in the area as seen by groups of inhabitants, such as children and pensioners, who usually are never active participants in these programs.

The process had 3 stages of mapping. In step one the difference between the lived-experience of the area was considered in relation to the professional drawings created to set the scene for the architects' design intentions. Step two produced a variety of residents' views on the area by using 'dialogue' methods [9]. Step three interpreted the dialogues to reach a synthesis.

Step one: Map of general architectural values.

The point of departure was made from an existing urban analyses of the area, the SAVE (Survey of Architectural Values of the Environment) atlas, together with the professionals' own urban architectural analyses [10]. This study of urban architecture was based on methods that primarily dealt with architectural values in homogenous, historic areas. The limitations to these departure points became evident as the task to hand revealed itself to be related to urban architecture in an inner suburb that is neither homogenous nor of particular architectural value. Nevertheless, it was from the outset accepted that the area has its own identity, local history and long-standing residents.

Step two: Map of specific values and problems as seen by inhabitants.

The map is a result of the dialogues between inhabitants and professionals. The dialogue methods take their point of departure in the professionals' expertise and knowledge of urban architecture. In the dialogue, professionals see through the eyes of the "locals" who often see things that are not of any immediate significance for professionals.

The project used innovative methods of dialogue such as 3-dimensional map interviews and photo-safaris for children as well as walk-through evaluations and picture sorting tasks. These predominately visual based methods were developed and tested specifically to reduce residents' difficulties in understanding the methods and language of the professionals and to elicit the residents' formal and tacit knowledge about their urban area. In walk-through-evaluation, residents and instructors walked on a pre-planned route through the urban area. At selected spots, notes on the urban architecture were made individually and discussed later with the other participants. For the photo-safaris, school children were split into groups of two or three. Each group was asked to find the three most beautiful places and the three most ugly places and identify them on a 3-dimensional map of the area. The children selected the best of the resulting photographs and exhibited them publicly with great success.

In viewing these photographs, it is striking that to children, significance rather than physical form is given importance. Moreover, it can be noted how the role of technology (in this case disposable cameras) empowered its users, enabling them to formulate and express tacit knowledge of their environment. Entrances, doors and gates are particularly fascinating to them. Yoshinobu Ashihara's theory of hidden orders in Tokyo's townscape is relevant here. He suggests that entrances form a complex order in the apparently chaotic urban streets of Tokyo, giving the streets discreet identities and that within a mixed-use urban area there are many boundaries, not all necessarily visible [11]. Where streets pass through these boundaries, significant "entrances" mark them. Entrances thus tell much about the identity of the urban area.

Step three: Map of Professional Synthesis

The synthesis of the professionals' mapping with the places pointed out by the residents encompassed the specific properties and the identity of the area. The interpretation of the dialogues resulted in a new synthesis of the general point of departure and the specific and diverse residential views. The resultant mapping shows islands of homogeneity in a wholeness of complexity. The islands have their visual urban orders (Modern or baroque for example) but the whole has complex cognitive orders of significance such as meeting places or patterns of local historical and cultural links. A notice board may be a useful metaphor for describing the complexity of the inner suburbs, symbolizing the social and architectural diversity of inner suburbs. The homogeneous parts can be "read" even if they differ in style, typography or language. But mixed urban areas have to be analyzed in ways different to homogeneous areas as they are of a more complex sort of order. This order refers to underlying structures and has hidden linkages, as found in the Holmbladsgade area. The tacit knowledge of the residents may be analogous to the underlying structures and hidden linkages binding the inner suburbs together and giving them their identity.

In the Holmbladsgade case the goal was to give professionals an improved understanding of an apparently poor and uninteresting urban area. For this, the residents had to be involved and new visual tools had to be developed for the dialogue process. These methods entailed a mutual learning process for both the researchers and the residents involved. The dialogue process influenced both expert and user opinions and knowledge. It represents common capacity building for future collaboration between professionals and residents, giving the latter real influence and engendering both economic interest and responsibility in the projects. The interactive and social nature of design coordination provides a more flexible process support environment in which the diverse contributions of distributed parties can be accommodated.

3. Nørrebro Park Kvarter: The Electronic Neighbourhood

While the Holmbladsgade project developed new methods of approaching urban renewal and public participation, a new project in Nørrebro Park *Kvarter* expands this process of dialogue between residents, professionals and authorities. Its intention is to integrate the new methods in the continuing process of urban and cultural change. 3-dimensional digital urban models had been usefully introduced to the Holmbladsgade project and had served as a common reference in the dialogue with residents. In this second Danish case (2000-2004) methods for facilitating participatory action of residents are further developed into a dialogue through use a virtual urban space created on the internet [12]. Here, residents are encouraged to interact among themselves and with professionals and in this way extend the urban topos they already experience. This expanded public urban space offers the opportunity to develop as a meeting place for exchange of information, opinions and for collaboration on matters regarding the regeneration process of their physical environment.

In the Nørrebro Park example, dialogue methods are developed by use of information technology to involve and to inform many more residents than had previously been the case. The maps of values and problem-areas elicited in dialogue methods are now made available through the internet to all the active residents as well as the about 50% of local internet users in the area. Dialogue research is developing in the direction of supporting the active residents with GIS based information, linked to a 3D city model and presenting views and evaluations from both active and marginal groups to the politicians and professionals involved in the regeneration project.

The intention for the electronic neighbourhood is that it develop in an ongoing process and take its form, details and links from actual debates, events and proposals in the revitalization process. It is the thesis of the ongoing research project that, by developing digital representations of urban topos and the creation of a virtual urban meeting space, new meanings of the physical spaces represented may develop as a result. It is specifically in this relation between virtual and physical worlds that further research is necessary.

AREAS OF RESEARCH

There is a thus a need to both understand and evaluate variances in the perceptions of end-users in relation to the designers' intentions, and to develop methods to minimize these differences. Moreover, where an existing environment is modeled virtually as a design and communication tool, architects may well be unaware of local interpretations of those places represented, and their significance for the community in which they are located. Research will be directed towards a quantitative and qualitative description of these differences in perception. Through collection of data in both South African and Scandinavia, an explorative comparison may be made for cross-cultural similarities and differences. These issues will be explored particularly as they relate to virtual and digitally represented environments, toward either confirming or negating their generally assumed superiority over traditional means of architectural representation. From a theoretical investigation of the above issues, experiments and data collection, it will be attempted to develop a limited set of methods for predictable results in user perceptions of architectural representations.

Two sets of relationship of real to represented environment will be investigated: in the first instance where subjects have a prior knowledge of the physical environments they encounter virtually, and in the second, where subjects have a knowledge of the represented prior to encountering the real physical environment. Specifically, comparisons will be made between spatial perception indicators in an existing environment, and similar indicators in its representation.

Potential outcomes of research or methodology.

For both real and represented spatial environments, tests will include the perception of height, scale, light, shadow, transparency, color, texture, sound, materials, level of detail and elapse of time. It will thus be possible to quantify and compare the results obtained from the two (or more) test-groups and assign a numerical factor of variation between them for the specific tests. Further comparisons and statistical analysis can then be made between the results for the various media employed in representation.

The production of statistical data, which compares perceptions or experiences in simulated and real environments will allow the drawing of conclusions as to those representations' accuracy in conveying the architects' intentions to the end-users.

With quantifiable perceptions of real environments as the benchmark, the comparison of either having or not-having prior knowledge of an environment when viewing its representation, will indicate methods for improving the accuracy of spatial representation.

SUMMATION

Urban renewal projects afford planning professionals an opportunity to facilitate attempts at creating new knowledge, while empowering a sense of community through participatory planning. Innovative information and communication technology expands this opportunity.

There is a need to consider the non-verbal language used in the dialogue between experts and users. The project in Cato Manor illustrates some of the problems associated with the emergence of digital information and communication tools in South Africa and its potential detrimental effects on participation through alienation of users.

Two recent projects in Copenhagen illustrate more innovative methods of enquiry into residents' perceptions of spatial identity. Both attempt to invite wider participation in upgrading of urban neighbourhoods. The first example attempts to create new knowledge through forms of dialogue between professionals and inhabitants, while the second builds on these methods and includes distributed, interactive 3D models of the neighbourhood.

The instruments used to represent planning and design concepts shape public expectations as well as influence the environments actually produced. Castells has written that the "space of flows " undermines the space of places [1]. The future implications for the use of virtual worlds in developments of this nature should not be underestimated.

Communication is a precondition for most day-to-day social actions, and which is in turn prerequisite to the interpretations of spatial identity sought between expert and users in the examples above. The language of dialogue used in information and communication technology must be understood in similar ways if it is to fully serve its purpose.

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Mediation, Non-Participation, and Technology in Care Giving Work

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ABSTRACT
Demographic changes are placing increasing emphasis in Nordic and other countries on the provision of care for elderly and other people in their homes. In this paper, the possibilities for a group of home helpers to act as mediators for the needs of assistees is discussed within a context of the changing information technological regimes of the local government.

Keywords
E-governance, IT, democracy, political mediation, public services

INTRODUCTION
Democracy at work was the major interest behind the establishment of what today is known as PD [2, 13] and for many contributors, remains so (e.g. [7]). Meanwhile, the spread of computers from the workplace into new domains (e.g. homes, schools) and in purposes (e.g. entertainment, shopping, advertising, and governance) has also widened the scope for PD interests. To deepen the understanding of these situations, however, Participatory Design needs to be supplemented by other approaches [5]. This paper is a study of lack of participation in care giving work. The backdrop is a municipality aiming at societal transformation using IT.

Widespread interest in "e-governance" [e.g. 8] appears to have combined with concern about demographic changes to make policy makers across Europe give increasing attention to the provision of care for elderly and other people in their homes. The potential of IT in enabling more assistees to be cared for at relatively lower cost is a current topic of research including several projects funded by the European Union. Meanwhile, the literature on effects of the information society has raised concerns about inclusiveness for vulnerable or marginalized people. This has often taken place in terms of a "digital divide" of haves and have-nots, leaving unaddressed the question of conditions for altering their situation [6]. In the present paper the above concerns are combined by exploring the conditions for participation in the provision of home help care and how this may change with IT. The focus is on the potential for home helpers to hear and to communicate concerns of assistees. As shown below, this is conditioned by home helpers' possibilities of being heard as well as by the technical-organizational environment in which they conduct their work.

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Ronneby and its Home Help Service
During 1992-2001, central officials of the Swedish municipality of Ronneby oriented to *"IT-samhälle"* (Information Technology Society) as an ideal for citizens and for governance starting from the formal adoption of a visionary document as municipal policy. The stated aim was to develop a society in which all citizens were familiar with IT (later modified to all municipal employees); which was to be known as such; and which consequently would attract software industry and workplaces. Existing and potential tensions between sections of the population were addressed in the vision document and special efforts proposed to smooth these out. Ronneby was to be a nice place to work and to live and IT was to be the means. The project which the present study is a part of aimed to understand how this ideal affected citizens and to what extent and through what means citizens may influence the aims and outcomes.

To explore the above question for service provision, a study was conducted in the Home Help Service: In Ronneby and throughout the Nordic countries, elderly and disabled people may receive necessary assistance from the Home Help Service (HHS). This is a municipal service to enable continued living at home. With roots in informal care giving networks [17] it is meant to complete these where they are inadequate (as assessed by HHS officials). The cost is primarily born by municipal tax income and the remaining fee depends on the income of the assistee and hours of assistance received.

Mediation

The paper examines the potential of home helpers to function as "mediators" for elderly and disabled citizens receiving home help in Ronneby. Rather than employing one of the numerous theoretical explorations of mediation, it uses a political concept of mediation focused on influencing decisions, in this case decisions about service provision and technologies that influence it. Mediators, in this sense, represent or carry forward concerns of one group to another; typically to a powerful group. Madon and Sahay have studied the substantial achievements of a non-governmental organization (NGO) in facilitating the concerns of a vulnerable group being carried forward to their local authority. In [12] they propose some 'mediation models' for analyzing information flows between citizens and government agencies. Although proposed for NGOs these open some interesting issues for the roles of the HHS in Ronneby. *Partnership* of NGOs *with government* involves, centrally, the incorporation into governmental efforts of lessons from NGO experience. This necessitates channels of communication between NGOs and government through which advocacy could be exercised. By *partnerships with commercial* organizations, Madon and Sahay understand strategic alliances between NGOs and companies, particularly where government fails to fill the need. When *acting as service providers*, professionalized NGOs work closely with government, perhaps with explicit contracts. While institutionalization of NGO work may ensure it gets done, such arrangements may weaken critique of underlying structural causes for its need. *Advocacy* has resulted in many successes for NGOs through lobbying, publications, networking, etc. The *accountability* of governmental officials is proposed by Madon and Sahay as the key to achieve changes through pressure from citizens and citizens' organizations.

Studying the Home Help Service

This paper is based on field work conducted during 1996-2001 in the Home Help Service in Ronneby. An initial interview study with supervisors and managers [3] had found a continual balancing of the needs of care provision against those of economics and efficiency. IT, while in daily use, was almost exclusively employed in service of the latter. To learn about how "IT" was experienced by people who provide care and who did not take computers for granted I next turned to home help assistants, focusing on a workgroup which had been designated a pilot group for IT for home helpers. The empirical method for the home helper study may be described as a series of small ethnographic studies in which the researcher made intermittent visits to a single group of informants. A few points are worth noting:

First, each visit lasted 1-10 days, the majority of which entailed 3-4 abbreviated days. The aim was to understand more of the character of this work and how the prospect and actual use of information technology shaped it and was shaped by it. Together, these visits constitute a study of work processes under changing conditions of computerization. Over the years the group changed in various ways. Changes included a substantial change in membership and changes in pressures on the group. The latter seemed to peak around 1998.

Second, my approach has been to understand the nature of the work of home help assistance by listening and watching, by experiencing it to the extent I could, and by asking questions. I was present during the morning meetings at which the schedule for the day's work was laid or finalised and during a number of conversations between assistants. Opportunities for initiating conversations arose at the group rooms (e.g. during breaks and after meetings) and while walking or driving with assistants. Traveling to assistees together also provided the opportunity for assistants to initiate conversations with me.

Third, during my visits I have taken part in the daily work—although less than fully, hence my hesitation to apply the term "participative observation." I have accompanied one or two assistants at the time on their rounds, visiting assistees and helping out where I felt I could. My interest in better understanding the nature of the distance I sensed between myself and my informants led me to broaden my focus from merely questions about their (somewhat ambiguous) relation to a PC in the group rooms to inquiring into the conditions under which their relationship to a host of changes (including the introduction of the PC) made sense. Substantial lack of opportunity for informants to participate in decisions affecting their work situation was evident early in my fieldwork. This paper is a result of analyzing causes and consequences.

Fourth, I have relied exclusively on field notes; quotes in the text are not to be taken as literally precise (subtleties are also lost in the translation). Conversations with home helpers were not automatically recorded, initially because they did not give such permission. Later I grew to enjoy the absence of a tape recorder because it forced an approach more focused on joint experience. Nevertheless, our relationship has been highly asymmetric. This is particularly the case with respect to the analysis but also evidenced by my speaking, frequently, of the "group" as if a uniform entity rather than individuals with various concerns and approaches to the work. Comments such as "what's she writing now?" have, however, provided opportunities to make available to informants more of my method of working and foci of attention. At times I invited comments from the group on emerging topics including the lacks in participation, which deepened my understanding.

Fifth, my own bewilderment at meeting care work in its at times unpleasant guises has been an important source of analytic questions about difference. Interested readers may read Isaksen's theoretical treatment of effects of the taboo associated with others' bodily fluids on care work (paid and unpaid) and on her own analysis [11] as well as my reflections on the distance between care work and computing [3] and on bafflement as an analytic tool [4].

Sixth, the field work provides highly limited insights on assistees' perspectives. This has implications for the scope of the discussion in this paper which focuses on the service provision. In Ronneby I have come across no attempts to facilitate assistees speaking for themselves on the service they receive. Some are unable to, but many address their grievances to those they meet: the home helpers. For these reasons, the home helpers bringing forward more of their views on assistees' needs would be an advance. Thus, while mediation may seem a modest aim its value lies in its potential to facilitate full participation.

VULNERABILITY

My exposure to assistees made vivid that a diminishing health has specific consequences, the impacts of which are not to be belittled. For some, poor hearing or eyesight leads to difficulty in engaging with familiar sources of information, inspiration, or participation. Poor mobility cuts others from familiar locations for meeting people. Additionally, for those receiving help from the Home Help Service, the inability to look after oneself or one's home may itself bear consequences as may the prospect of eventual "incarceration" in an institution. The latter was evidenced by some assistees' explicit misgivings. Other studies have found considerable strain from drawing on the resources of relations and neighbors over years [11] and strain even on professionals in prolonged, close relationship with people with senile dementia [14]. In exploring care-giving for elderly people who have lost control over some of their emptying functions Lise Widding Isaksen describes control over the body as having become an area of performance in contemporary society, causing extra pressure on elderly people and on their care takers to hide failing control [11, p.9]. Isaksen has reflected on failing social networks as one consequence and on the low status and salary of "close-to-body" care work as another. Extending Isaksen's argument, attributes of age such as life experience, wisdom, etc. are not prominently valued in contemporary Nordic societies; instead, "adaptability" and quick learning, physical beauty, knowledge of other places and of technology—i.e. attributes of today's youth—are.

Home care recipients (assistees) in Ronneby can thus be expected to be liable to exclusion from dominant society by virtue of failing health and their age. Vulnerability, a term used in Development Studies (e.g. [10]), may help explore some of the potential and actual difficulties experienced that influence the lives of home care recipients and which ideally would influence relevant government policies.

Some elderly or young people who can no longer fully look after themselves appeared to find the help of the Home Help Service easy to accept while others expressed resistance. Individual assistees expressed appreciation verbally or through offering assistants e.g. a cup of coffee and resistance e.g. by addressing assistees in abusive terms. Explanations may include differences in how the service is actually offered, but it also seemed that some found it hard to accept a fate of considerable reliance on others while others did not, or they considered the service their right (e.g. as a tax payer or as a senior citizen). By virtue of having to accept help, I label all vulnerable with respect to municipal service provision. It is important to remember, however, that vulnerability was a specific aspect of the situation of a care recipient. In taking this perspective I exclude many of the resources—personal and social—and sources of joy that were also in evidence when visiting assistees.

WORKING BETWEEN VULNERABLE CITIZENS AND THE MUNICIPAL AUTHORITIES

My argument is that the home help visitors (home helpers) are in an "in-between" position with respect to, on the one hand, elderly and disabled home help recipients, and on the other, the municipal authorities and their policies. This builds on their closeness to assistees.

For some assistees the regular visits of the Home Help Service provided the bulk of their interaction with others. Many kept informed about and interested in those who assisted them, asking e.g. how their children or husbands were doing.* Generally, relationships were based in and strengthened through repeated contact about everyday issues such as assistees' personal habits, difficulties and how they handle these; their preferences, e.g. what bread they like or what cat food to get; and assistees' relations to relatives and friends. For a few assistees, the District Nurse and the HHS supervisor had allocated time also for sitting down and talking for a few minutes. The fieldwork clearly showed that more contact between an individual helper and assistee meant more knowledge and usually also a deeper mutual understanding. For example, I experienced substantial differences in how assistants dealt with assistees (particularly those considered "difficult") and the extent to which they were able to prepare different kinds of space for my presence depending on who we were visiting. , e.g. informing me about assistees we are to visit and preparing me for our joint work with the assistee. Comments could be "you could go into the kitchen and start preparing breakfast," "S. will enjoy meeting a new person today," "I wonder what mood R. will be in today." I have been much heartened by the care and subtlety with which, I eventually realized, not only assistees thus were protected from my potential intrusion, but also I was protected from assistees in a less than sociable state of body (e.g. while preparing to shower someone wearing diapers) or mind (e.g. while waiting for caffeine, tobacco or medication to take effect). Both the skillful provision of service—including such subtle management of breaks of cultural taboos [11]—and, it seemed assistants' satisfaction with the work despite its unpleasant sides, relied on mutual familiarity developed over time. This was recognized in the HHS policy of assistees having the same assistant visiting when possible.

Home helpers could be heard lamenting not having more time at their disposal to talk or sit with assistees because they recognized addressing deep needs for human contact as an important part of their work with respect to many assistees. Some relationships between home helper and assistee entailed mutual joy—and given more time together, more of them probably could do so. In other cases the recognition of their role as part of a relationship was evidenced, e.g. by someone invoking the difficult life situation of the assistee during conversations that centered on some recurrent difficulty: "But of course, it's hard for him to live like that, with ... (various ailments)." Often, this would bring the discussion to an end.

The position "in-between" assistees and municipal policies operates in at least two more senses. First, they provide the service itself as employees of Ronneby municipality, thereby constituting one of its interfaces with the public. In this, they also answer questions that may turn up, thus mediating queries and constituting a channel of communication. I have mostly seen this in two ways: On the one hand, pre-emptive, where the home helpers initiated conversations as vehicles for helping, e.g. about health issues or the birthday of a relative. In so doing they created opportunities to subtly remind someone of an appointment, check the person's understanding, or offer relevant information. On the other hand, as "fellow citizens" they were expected to know, or potentially know, about events, changes, etc. I have seen home helpers initiate conversations e.g. about the season, forthcoming social events, close relatives, etc., telling me afterwards that this assistee particularly benefited from having their interest aroused, and I have seen assistees ask the visitors, e.g. about Christmas decorations in the street.

The second sense in which the home helpers are "in-between" policy and assistee is through their shaping of the service they provide. This showed, among other ways, through the home help visitors engaging in continuous negotiations with recipients over work limits and expectations. According to the fieldwork, the extent to which this was needed and how it was handled varied considerably, not least depending on the personal relationship between helper and assistee. This, as the above, is one of the axes around which relationships evolve, between home helper and assistee as well as between home helpers. Experienced home helpers were highly skilled at such interactions with assistees—including not only smooth handling of contrasting positions (i.e. of potential conflict), but also pre-empting their arising: Through shaping expectations of assistees, often in subtle ways, positions were aligned by encouraging certain expectations from assistees and discouraging others. At times I heard difficulties expressed to colleagues and to me, out of earshot of assistees. This seemed to enable limited "venting" of difficulties while shielding assistees. Sensitivity to and understanding of the strain under which many assistees were forced to conduct their lives marked many such conversations. Only a handful of times have I witnessed rules being evoked in front of an assistee to support an argument. Thus, limit setting was mainly handled through skillful guiding of conversations towards what is to be understood as "reasonable." This may be termed "mediating for recipients' reasonable expectations."

The position of home helpers as mediators between elderly and disabled recipients of municipal services was at times fairly uncomplicated—basically when the support system was working as intended and recipients accepted its limitations. In high pressure periods, however, home helpers faced difficult tradeoffs. I saw many examples of trying to distribute the strain; reducing own breaks, postponing non-urgent work, and passing on some of the grievance to their superior. The supervisor often refused to address the situation, saying she was locked by her budget (e.g. when refusing to call in replacements for staff absences, or calling in fewer replacements than those absent). Thus, their possibilities of actually resolving such situations by removing the strain was minimal, as the recurrent source of problems was staff shortages over which they had no influence. Thus, in contrast with the subtle skill with which many potential difficulties with assistees were avoided, other aspects of shaping the service appeared to be considerably more troubling. In question was resistance against being placed in a position of mediating unreasonable expectations—i.e. the home helpers were expected (by "the system," represented by superiors) to keep providing a reasonable service, without having the staff resources to do so. The pressured trade-offs led to difficult discussions among the home helpers where several loyalties were in conflict: To the supervisor/the system/the municipality and its need to save money (e.g. when a home helper advanced an argument to colleagues emphasizing understanding of why the group is short of resources), to immediate colleagues (such as trying to split the work load fairly between them, but by which criteria), to own rights as employees (including responsibility to own family needs, or other resistance against getting too tired), and to help recipients. Perceptions that colleagues were not prioritizing assistees sufficiently led to the strongest intra-colleague conflicts I saw. This occurred during a period when it was often impossible to make the daily schedule come together. Although many home helpers regularly gave up their breaks bi-weekly cleaning was repeatedly postponed due to staff shortages. Assistees made few formal complaints although home helpers sometimes encouraged it. Conflicts arose over how long to accept such a situation and to whom and how to react when it was felt the limit was reached.

The complex tradeoffs arose when the system did not work as intended. Several axes of concern mix such as the needs of home helpers as employees (with rights to a lunch break, and not to work overly hard) clashing with the statutory rights and "humane" needs of recipients. Dealing with this as part of everyday, regular work also entailed a partial hiding of these difficulties from others.

THE "BETWEEN" POSITION AS MEDIATION

Before discussing roles of technology, I next explore mediation. Being employees of the local government authority and carrying out services it is required to provide, home helpers were liable to act, and to be received, as its representatives. "Representation" was reinforced e.g. by their cars for a while carrying the municipal shield and name; also, in the ongoing negotiations with assistees discussed above, limits against other municipal bodies and services were often in focus. Home helpers, thus, were required to carry out and at least partly defend decisions and structures of the local authority. (I have seen the home helpers outwardly defend the system, despite internally expressed misgivings). It is this complex interrelationship I wish to explore using the models in [12], presented above.

Advocacy: The question of advocacy in the Ronneby study is whether the home help service could have an advocacy role for elderly and disabled citizens at least for issues concerning the assistance they receive. I argue that home helpers occupy a position from which they could and partly do act as advocates (but highly subtly and in limited respects, the impacts of which are uncertain). In my analysis the Home Help Service operates in a hierarchical way, contributing to a lack of openness to two-way negotiation between those lower on the rung and the managers. Complaints have consistently been made in my presence over the years by various home helpers in this group that their professional opinions are not valued by others in government; including their immediate superiors ("They don't care"). While initially I found these complaints disturbingly polarizing, over time I understood how such a perspective had had fertile grounds for blooming in the meetings between supervisors and home helpers.

For example: a) When having to change group rooms, group members themselves were engaged in finding a new venue, telling me they had been asked to do so by their supervisor. Eventually a suitable location was found. Then, however, they found the supervisor not open to their suggestion after all, as other (free) rooms had been decided on. This had not been communicated to the group whose members had spent considerable amounts of time and effort finding a place that was suitably located and sufficiently economical. Group members were not happy about what they experienced as off-hand and unpredictable treatment by their superior. b) At another time, when the coffee machine in the group rooms needed replacement, money was only granted for one of second quality. This was felt by home helpers as a sign of disrespect, especially as the amount saved was small. c) In 1998 I was present once when the supervisor visited the group rooms. After some general talking she announced that she had cancelled the agreement with a security company that provided the secure key tag service they had been using. Upon hearing this, surprise was voiced and questions rose as to how they were to securely keep track of the many keys kept to assistees' homes. The response was that it was necessary to save money and "I'm sure you'll work out a solution." After the brief meeting home helpers confirmed to me that they had not heard of this before. An alternative solution was worked out, but the episode added to the impression of a non-participative style of management. d) In 2000, when asked for feedback on my analysis that they don't get to take part in many decisions that affect them, one home helper exasperatedly said that home helpers are continually told of the need to save money but initiatives from home helpers even within this area are unwelcome. She told me the following example: Once she suggested a cheaper way of obtaining disposable gloves but this was not welcome as the HHS had an agreement with another vendor. In itself she found this easy to accept, but not the disinterest she felt met with: "Contracts come to an end—won't this one too, at some point?"

A pattern emerges in which the group is, on the one hand, asked to take responsibility for resolving issues (both regular, such as daily scheduling even in face of under-staffing, and ad hoc, including issues that arise from supervisor decisions), and on the other, may be overridden at any time by the supervisor. While we may safely assume that the supervisor is acting according to her concerns, which may be important enough and understood in light of the pressures she faces, of primary interest here are the effects on the home helpers, in particular on their ability to carry forward their concerns for assistees.

While I have only interviewed in this group, there is reason to believe dissent to be widespread. At one point my informants discussed refusals by colleagues in a nursing home to comply with new regulations and threats of industrial action by a different home helper group. The latter made it to the local paper: Causes given were the lack of a promised pay rise and lack of patience with an increasingly difficult work situation including rising numbers of elderly, more heavy work, more tasks (including alarm handling), a new educational requirement, and stricter regulation of what they were and were not permitted to do for assistees (notably threats of job loss if regular breaks of the new rule not to shop for assistees who do not accompany them was detected). In reference to the latter, assistants are quoted as saying: "The fact that we work around this by giving a hand during our spare time is no-one else's business."[14] The new restrictions on shopping and cooking for assistees roused considerable grievance also in the group I visited. These reactions contrast sharply with views on what constitutes home help assistance in some technology-focused research and development, including [1, 9]. E.g. Heikkilä et al. assert: "Any relief in the burden of daily shopping may make it possible for the home helpers to concentrate on duties they are hired and trained for, and for the elderly to gain access to [a] wider selection of services." [9: 338].

To date, then, the study has uncovered no effective channels for advocacy within the home help service in Ronneby or long term plans that would change this. A 2-page form does exist for recording, with the participation of the assistee, her capabilities, wishes, and resources current and needed. I see this as a convincing tool for eliciting and recording such issues and it could be used as a tool for advocacy. However, I have only seen such forms at a supervisor's office and not in the hands of home helpers. Further, home helpers do not have authority to initiate action to meet the goals. Thus, while this form seeks to strengthen the position of the care recipient with respect to the service provided, those in the service with most contact with her may only carry out practical aspects as decided by others. The impact of this form, then, is highly limited. A further channel is the general possibility to call the supervisor and discuss issues. In practice, however, this seems to me under-used even to complain about lacks compared to the agreed levels of service, so I consider this an unlikely candidate for a channel for serious discussion of the terms of the service itself. In conclusion, worthwhile initiatives such as the form notwithstanding, responses to the service provision as such and its terms do not seem encouraged in any channel.

The above identifies a need for effective communication channels *within* the government, between those in closest contact with a vulnerable group and decision makers. In terms of the NGO situation with which Madon and Sahay's paper is concerned, the above indicates a need to diversify discussions about government: The strain and differences evident between employees of government in the Ronneby case poses the question of *whom*, or what interests of government we are talking about (as opposed to government as such).

Accountability: While corruption is not considered a problem in the home services in Ronneby, other issues of accountability could be. Assistees may hold the nearest government employees accountable to the extent they talk together—and my sense is that several elderly tried, subtly, with the home helpers—but these are not decision makers. Thus, the system has "accountability," but it is hard for an individual to locate as it is frequently "elsewhere." While at each level municipal employees appear to be doing their job properly the question of whose concerns are to shape what that means, keeps receding into the horizon.

Partnership with Commercial Organizations: This model is not applicable, yet provides interesting points to consider. Partnerships with commercial organizations is looked to by many who influence policy in Ronneby and elsewhere as providing solutions to some current and expected future challenges for the Home Help Service. This is a key interest for the present project and is further discussed under "Technology" below.

Already, agreements with commercial organizations, e.g. for exclusive deliveries of disposable gloves, help mediate the existing structure of the Home Help Service. Being a sizeable bureaucracy, agreements are made with the Government as such, represented by the relevant branch, i.e. the Home Help Service, represented by managers. Such agreements can facilitate evasion of participation, by in effect freezing beyond questioning a number of details that shape tools, and therefore work practices, of home helpers. If there is no participation in the decisions and negotiations leading up to agreements with third parties they lend themselves to reinforcing hierarchical domination through the receding accountability discussed above.

Acting as Service Providers: While at first sight nonsensical—the Home Help Service *are* the local government's service provider—this mediation model raises the question of the effects of institutionalization. The service originated in the practices of extended families and of neighbors looking after people in need; this was gradually institutionalized with pay, formal employment, etc. (for the Norwegian case, see [17]). Established to complement other networks and services, the HHS is in some senses meant to be complete and for all. While providing a much appreciated service with considerable stability and dependability, being part of government also entails constraints (notably, budgetary) originating outside the relation of helping. The resistance against new regulations, then, may be an indicator of the partial failure of the institutionalization; the difficulties in being heard and bringing forward concerns for assistees may be an indicator of its partial success.

An interesting question is to what extent Scandinavian welfare models have assumed both their own completeness and the ability of government welfare agencies to advocate for their users/clients. There may be a paucity of research that facilitates understanding of long-term issues for clients [16, p.137].

In conclusion, home helpers do seem to be in a position in which they might act as advocates for assistees. Yet, there is little evidence of such a role being enacted. Could new technologies change this? The next section examines existing technologies and the potential of more ICTs.

ROLES OF TECHNOLOGY

Home help as currently understood is inconceivable without a number of artifacts we might think of as "technical." They played three major roles in the work of the home help group I have studied. First, technical artifacts were used for mobility. Distances between homes covered by this group necessitated the use of cars and bicycles for transport as well as walking. Thus a fundamental premise and requirement was the mobility of staff and technical aids to ensure it. Second, in the homes of assistees there were technical aids over and above those usually expected. These included chair lifts, alarm devices, and wheelchairs. Thus, technologies that may remain the property of the municipality or of some other body, or may be the property of the person using them, are a second given. Third, various technologies enabled the home help service to present itself as a coherent service, as part of a network. These are in focus here, partly because they are contested in the service (through problematic introductions and usages) and partly because such technologies are my research concern.

Technologies of information

A considerable number of "information technology" devices were in use at various points of the service. Focusing on the home helpers' work, these included telephones (stationary and mobile), various paper based repositories, a whiteboard, and a PC. The group rooms had a telephone which facilitated (stationary but remote) communication, frequently with supervisor and district nurse. Also in use were mobile phones, both official (for the "alarm") and private (for coordination of mobility—being picked up by colleagues in a car nearby). Various paper based repositories were central to the organization of work. The work of distributing the day's work was organized around an A4 pad on the large table around which the morning meeting took place, in which the daily schedule as it emerged during the meeting was recorded (with a careful alternation between pen and pencil to allow maximum ease of alteration during the meeting and later). Small strips of paper were used by each home helper to record her or his duties of the day, affording economy of recording and maximum mobility. A notebook for writing down messages about a specific help recipient for the use of the District Nurse (who may or may not read it) had also in periods been kept on the table. Various forms and memos recording schedules for each employee, changes to practices or rules, social activities, courses etc, resided in a folder on or near the table. The whiteboard, prominently visible from the table, found two main and interconnected uses. First, it held messages. These mostly concerned various recipients, e.g. this person is going for X-ray on such a date and time [I have seen numerous such messages on the board] or that person was admitted to hospital last night [this I have rarely seen, despite or because such news received full and at times prolonged attention in group room conversations]. Also messages about car maintenance and, e.g. my arrival. Second, the whiteboard displayed staff working schedules summarized for the week (overall view summarizing who was on duty each morning, afternoon, and evening). Thus, the whiteboard assisted coordination between days, affording easy view of events in the near future. A new arrival as of mid-1990s was a PC. Its purpose was unclear to group members at the start of my field study with them, around one year after its introduction—and remained so for a considerable time (years). By 2000 it had finally gained a purpose recognized by the home helpers as relevant for their work: A system had been implemented for receiving messages from the hospital about discharges of assistees. Assistants, however, never received adequate training.

Distance and communication

All the technologies which formed part of the work environment of home helpers, described above, had in some sense the purpose of helping assistants help assistees to remain living at home. Only one cluster of technologies did so directly: the second one (lifts etc). Another cluster of technologies, those enabling mobility beyond walking, was necessitated by the current centralized organization of the work. A joint assumption behind these technologies was the desirability of co-presence (one assumed it, the other enabled it). In contrast, those technologies that I above refer to as a third cluster (facilitating the Home Help Service as a system—whether paper based, phone, or PC), assumed and enabled a centralized-distributed pattern of information and of work (i.e. distributed presence controlled or coordinated from centers elsewhere). In this sense, the former technologies afforded the development of relationships between home helpers and assistees; the latter afforded distancing. The technologies of mobility transported and transferred home helpers between these realms: Crudely put, when home helpers left the group rooms and got into their cars, onto their bicycles, or started walking they were also leaving "bureaucratic" organization and entering "relationship" as the dominant voice. These were not separate. On the contrary, field work to date indicates recurrent tensions between these concerns. Most time was spent in the "relationship" realm, but in case of conflict, the realm of "bureaucracy" was meant to have the final say (it did not always do so, as complex judgments including those of moral right entered the scene). The different natures and purposes of these clusters of technology go some of the way towards explaining the multi-faceted relationships between members of the home help group studied and the technologies they were, or could be, using; in particular the ambiguous relationship to computer terminals.

A "technology" (or "network" or "service") that demonstrated the integral nature of interconnections between the organization of work, technologies in all three categories above, and external conditions in the provision of service, was what I may call the alarm network. This consisted of alarm devices placed in the homes of subscribers (a phone and/or large push button); the alarm center (basically a specially trained switchboard function: the person at the center communicated with the subscriber who had sounded the alarm, decided if assistance was required, and if so, initiated help by calling the home helpers); and a mobile phone (carried by home helpers and referred to as "the alarm"—as in "Who'll take the alarm today?," a question frequently heard after the morning meeting). Until and including my 1998 visit this was a local network geographically located within Ronneby municipality and organizationally located within the municipal Home Help Service. The alarm center was staffed by a supervisory official of the Home Help Service. By my next visit in late 2000, the alarm service had been further centralized; alarms now went to a regional alarm centre located in a different city, who called the home help mobile phone. This caused problems as the regional center was considerably busier and its staff rarely had knowledge of Ronneby or of how the Home Help Service worked. (By late 2001 these difficulties no longer troubled informants.) These changes were yet another example also of the lack of influence by home helpers over decisions that may considerably change some part of their work, even when the new model of service provision requires—as in this case—additional effort from them or a poorer service or both.

The above description of the changing alarm network shows, further, an example of the continual changes in the technologies themselves, the work processes around and with them, and the context in which they are used. This applies more generally, in a complex interplay of elements. Information technologies may be particularly volatile and the causes for change hard to untangle. For example, after a move to new group rooms the whiteboard saw less use. Reasons could include the white board being more awkwardly placed; the "break" area now being in a different room, taking people more away from the whiteboard; the staff shortage being less pronounced; or a representative of the new supervisor having started to attend morning meetings, thus reducing the need for written messages.

Information and communication technology (ICT)

As alluded to above, ICT is often held to deliver great promises for the future of home help service provision. A combination of IT and service delivery companies are to make the service more efficient. Early experiences, however, call into serious question the roles assigned to assistees in the development schemes. Moving from visions to attempted implementations within a few years, the scope of concerns seems to exclude voices of assistees, their relatives, and also their potential advocates. In these efforts—much talked about in the Nordic countries—the advocacy role discussed above seems to retain no force. The increasing numbers of elderly people during the next 20 or so years and the impossibility of dealing with them with today's service appear to be powerful arguments for a focus on economics. In Sweden an example is [1], a report produced by organizational consultants with the participation from HHS supervisors. This report proposes wide-ranging changes for the Home Help Service to become more 'efficient' by splitting it up and introducing e.g. motor cycle deliveries and e-prescriptions directly from doctors' offices to pharmacies. In it, little or no consideration is given to how to arrive at this scenario or to the difficulties of transition and the possibility of extending the service along other, arguably more humane lines do not figure in the discussions. Its expectations that time saved in the Home Help Service would be spent talking with assistees seem naïve considering staff complaints of a general intensification of the work (e.g. earlier discharges from hospital led to savings elsewhere; the heavier burden on the HHS was never adequately compensated). Previous experiences in the Ronneby Home Help Service of inadequate training in IT similarly weaken trust in such projects. Heikkilä et al. also propose splitting up services through IT in their comparison of shopping done by home helpers and through other means. They conclude: "The home helpers' time, that will be released through the use of more sophisticated and time efficient models of grocery shopping, can be used to increase the personal contact time with current customers or to provide services to additional customers." [9, p.348] While Heikkilä et al. acknowledge this being "a social political decision," both [1, 9] beg the question of what the basis of 'personal contact' is thought to be if shopping, cleaning, etc. are removed from home helpers and carried out by various specialized delivery and cleaning contractors. In contrast, the field work has shown the relationships mostly to be constituted precisely around such mundane tasks.

IMPLICATIONS: RELATIONSHIPS, THE HOME HELP SERVICE, MEDIATION, AND IT

The personal contact, the extensive knowledge of assistees' difficulties, and their sensitive hiding of the intimate details of associated breaks of cultural taboos, form in my view a powerful basis of the mediation potential of home helpers: there was compassion, understanding, and mutual trust. This mediating potential was being realized in terms of tailoring the service provided, but for reasons detailed above, less so in terms of shaping the conditions for it, or of otherwise reporting common concerns of assistees to others sectors of the municipal authority.

To the extent that the home help service is expected to provide for elderly and disabled citizens in need of municipal assistance to keep living at home, the service may have a mediating role between needs of assistees and the public responsibility to ensure it is met. A proviso in this line of thought is the willingness to place centrally the needs and rights of citizens/assistees, rather than, for example, the financial imperatives of the municipality. While the former is unambiguously stated as the grounds for the Home Help Service in Ronneby, its practices are observably also conditioned by the latter [3]. The mediation focus provides some interesting perspectives on the gaps between the potentials of the home help service and what it in practice is left to do for the elderly. Taking the mediation models as a starting point the service has been identified as having potential as mediators, and failures in realizing this potential are partly structural, partly contingent. Altogether, the home help service has the potential to be an effective mediator between concerns of those needing help at home and the government, but appears to fail on several points. Primarily, those who are closest to the assistees are made to only deliver, not shape the conditions for the service. These are rather determined by others who physically and in terms of concerns are more remote from the assistees. Secondly, they are not given the staff resources to perform as well as they feel they could and should. Staff shortages cause excessive staff rotation and outright postponement or cancellation of promised services. Both erode trust and weaken relationships. Root causes of failure to realize the potential advocacy within this local government agency thus seemed to be the imperative to save money and a hierarchical culture, in which initiatives from those with most contact with assistees were undervalued. In this light municipal efforts at improving services to citizens through increased use of web applications ("24-hr government") seems to stay with surface problems.

The key issue for change with technology-facilitated reorganization of the Home Help Service is whether the opportunity will be taken for visionary organizational changes that facilitate advocacy and participation. Sadly, indications are that the shortfall situation seems likely to deepen in the future. Services are gradually fragmented; more people are dealing with each care recipient resulting in smaller surfaces of contact and severely reducing the possibilities of developing mutual understanding and channels of communication.

The question of the ability of home helpers to realize their potential as (partial) mediating advocates for elderly and disabled citizens in Ronneby municipality has repercussions beyond Ronneby. This study has been an example of the distance of PD from institutionalized practices of employment, accountability, and authority in a Scandinavian local government service.

A technology lead in Home Service development projects is all the more serious as IT is expected to solve mounting pressures on the home help services and appears to be the dominant heading under which change is considered. In contrast, I hold that IT has the potential to bring a range of improvements to home service shaping and delivery that would support the mediating potential of the home helpers for those in need of assistance at home. This requires a different starting point, however, focusing on assistees' expressed needs and how best to elicit and shape the service by them. IT could, then, be put to new and unimagined uses in the Home Help Service. Concerning *organization*, home helpers "on the ground'' would need to be placed centrally in the development teams (Participatory Design techniques for the participation of people with more skill in the work concerned than in computing have been developed and could be put to use). One might also ask right from the start how issues of scalability will be dealt with. If the start is a limited project, how to extend the development work in time and place to encompass the daily provision of this service? Could other ways than "projects'' be imagined for a development effort? Concerning *topics* for such "alternative'' uses of ICTs, one starting point might be the fundamental importance of one-to-one relationships in the Home Services of today: If this is to be valued as an aspect of the Home Help Service of the future, how can ICT facilitate the development and sustenance of such relationships? Answers to such questions might range from applications of existing technical solutions (maybe email), to hitherto unimagined ones that might provide a challenge to existing conceptualizations of computing development. A different starting point might be the continual trade-offs between different concerns, including imperatives to save money, looking at ways that home helpers might exercise more (or even less) overall responsibility in finding solutions in the form of workable tradeoffs. Another starting point again might be the training needs of home helpers and of assistees, possibly bridging generation gaps while building on and developing further the roles of home help assistants as mediators between municipal policies and care recipients. If home helpers were to support elderly in learning ICT use this would constitute a new way of thinking of the Home Help Service in terms of task but not so much in terms of relationships and mediation: This would build on existing relationships as well as on the idea and practice of home helpers "bringing external impulses" to home-bound people. It would also give a new impetus to the municipal IT project, allowing spreading of ICT knowledge in novel ways, developing the Home Help Service as a mediator of familiarity with ICTs (rather than the HHS being relegated to an ambiguous end point of efforts to spread ICT). A fourth starting point for ICT development projects in this realm might be the potential for a political mediation role, examining ways that home helpers might make use of ICTs e.g. to communicate concerns about assistees to them and to pass on their understanding of general issues to decision makers. The latter would link up well with the existing "IT and democracy" efforts of the municipal authorities but would require decision makers to be willing to listen to the wealth of experience of home help assistants.

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FOOTNOTE

[*)] I have been impressed that despite my infrequent visits a few assistees have even remembered me. One elderly assistee I had met several times over the years, mostly only a few minutes at the time. When visiting in December 2000, her body—as so often before—was shaking with Parkinson's disease while she was waiting for medication to be given and to take effect. We had last met in 1998; yet, she remembered my name, details of my family, and my work as a researcher in computing. I remain deeply touched by her extraordinary memory and willingness to see me as a whole person and ours as a real relationship.

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Digital tools for community building: Towards community-driven design

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ABSTRACT

This paper describes our participatory design approach with two communities of interest. We discuss the tools and context of conversation and design we have been experimenting with within our research project. The paper presents a working idea of application patterns, as a useful concept for pursuing holistic interpretations of people's needs. We believe that participatory design processes driven by communities, that are developing new ways of solving their needs, might result in the emergence of new and creative applications of future digital technologies.

Keywords

Communities, design partnerships, digital exchanges, interactive scenarios, application patterns, digitalization, digital media participatory design

INTRODUCTION

Besides being a technological direction, digitalization affects everyday life in many concrete ways: processes, media, activities and even objects that appeared with a particular design in the material world, are being redesigned and reconstructed in digital formats (an obvious example is the emergent use of a mobile phone's phonebook as external memory or the fact that a lot of our interactions with institutions, like banks, are now made mainly through network connections). Under such circumstances our everyday life will be affected more by the "systems" that are being designed. We believe that more people need to have a voice in this development. This approach has long been advocated by the participatory design tradition [11], especially in the area of work related technologies, as the Scandinavian approach testifies [4].

. More people engaged with design might help to propose directions that are more responsive to our diversity. As pointed out by critical approaches to technology development, the survival and shift of agency in the decision making process of technology, is not only contested in the social, but can also be affected in the design process. [5] [12]. However there is still much work to be done when it comes to approaching designs that might support "ordinary" communities doing "ordinary" things. This area remains a largely uncharted territory. One of the problems we have found relates to envisioning with people (ordinary users), issues regarding the new potentials and special qualities that software brings in to the equation. Most of the time people lack vocabulary and concepts to understand how to best take advantage of the possibilities and use them to their benefit

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SPECIAL COMMUNITIES: generating partnership

The communities we have been working with display divergent characteristics and allow us to approach the multifaceted problems from many perspectives: various contexts, age groups, media uses, cultures, and values. We want to consider a reciprocal and continuous research that addresses their concerns. In this view design partnerships not only seek to solve problems, but also try to identify problems worth being solved [10]. By facilitating the organisation of activities, the flow of information, their transactions, and empowering them to express their points of view, the communities and we might discover new potentials together.

A community approach moves away from issues that regard only working life, productivity, efficiency, etc. It also helps us to transfer the focus from a "product point of view" and take into account the various social aspects and holistic applications people might have. In the following we will present two communities, who have a very clear goal, an alternative way of doing something and a keen interest in getting there.

Communal living, alternative ways of growing old

Aktiiviset seniorit ry (http://arki.uiah.fi/loppukiri) -Active seniors- is a non-political association founded in the summer of 2000. Its purpose is to develop a new kind housing arrangement for aging citizens based on neighborly and self-help. The idea is to enable a spiritually challenging and socially accomplishing housing in the latter half of one's life. During January 2001 the association got a HITAS (price-regulated) lot from the city of Helsinki in the new housing area of Arabianranta. Loppukiri (Spurt) -as the project for building the house is named- aims at building a strong community. The community will cook and eat and clean together among other activities. There will be 50 smallish apartments (between 30-70 square meters each), but large common areas, including library, kitchen, dining room, possibly a guestroom and an activity room. Before the actual house exists, they are engaged in finding ways to build an active community out of for the present geographically dispersed group of people. Once their house is in place, new challenges are bound to emerge, to issues like taking care of themselves and sustaining their community.

Nurturing diversity

Mi Casita (http://www.micasita.fi) is an active community founded in 1994 by a group of families, with the purpose of arranging Spanish-speaking daycare services for small children. In Mi Casita both Finnish children and children of Hispanic origin have the opportunity to use and learn Spanish and get to know aspects of different Spanish speaking cultures.

Mi Casita is run by the parents' association; which creates a special relationship between the families involved. It gives them a particular degree of freedom to set their objectives and certain special needs in terms of communication and sharing of resources. Along the way the multicultural aspects also pose challenges and opportunities for interactions and the formation of a strong community.

WORKING METHODS

Contextualizing: - starting dialogues

Rather than assuming a fixed relationship with technology, we are concerned with the kinds of relationships people are interested in having with it. In this sense the contextualization stage concentrates generally on finding connections and identifying relevant applications and patterns (this approach is explained with more details later). We conduct interviews and sometimes use a "light appropriation" of ethnographical methods like participant observation (mainly for the case of children in which interviewing becomes a more complex process). Interviews or sessions are, as usually, videotaped or at least audio recorded. Clips of them are produced, and analyzed afterwards, to gain a common understanding within the group. The material is afterwards shared with the communities, and has proven to be an interesting communicational resource.

Due to the size of the communities, it would be difficult to get extensive interviews with all the members. How to start interacting with as many members of the community as possible, and make them feel part of the process? We have been experimenting with alternative ways of generating dialogue both with the communities and within the community. The starting point has been a series of postcard-like questionnaires and sets of action packs, inspired in particular by the cultural probes approach developed in the Presence project (European i3 initiative), [7][8]. The cards have been designed to contain a question with an accompanying cartoon-like illustration. The illustration is visually "commenting" the issue, and there is space to fill up the answer. Sets of these cards were given to all the members of the community, they were asked to take them home -time to reflect on the issues- and return them to us in prepaid envelope. As in the original probes approach, answers can remain anonymous.

The action packs contain a series of tasks to be fulfilled in a few days. They range from documenting the use of different media during a particular day, collecting articles and intangible things worth to share with their close networks of people, etc (some of the tasks were suggested by the community itself)

More than pursuing objective answers, the interplay between the illustration and the question, the tasks and the materials given to realize them, aims at provoking and inspiring thoughts around particular issues. These materials have brought up fruitful topics for analysis that are then used in a workshop setting with the participants.

As a concrete by-product, it is clear that it has also been useful information for the community itself, as the simple questions and the tasks have provoked people to think about their relationship to the community.

Digital Exchanges

Both with Mi Casita and with the Active Seniors, we have been designing and implementing community websites. These sites host information they produce and want to provide for the outside world. More importantly it provides a closed (members only) space. This community area contains a set of tools for content creation and exchange. It is also intended to hold a shared memory of the community, works as a communication media, while aiding up in the process of building the community.

This concrete design activity has helped to create rapport and partnership and to test some methods through a very concrete project, addressing the community as a whole. At the same time the design of these spaces enables them and us, to elaborate future directions, since new vocabulary and problematic relevant for other applications and scenarios started to emerge from them. Even though these web sites are important end products for the communities, we feel they are essential tools for research, as participatory design research environments.

Interactive scenarios: building partnership

As tools for conversation we have used scenarios not to tests ready-made concepts but as components in the process of enabling people: first to express their opinions considering digitalisation trends and ICTs [2], and secondly to propose and comment new alternatives and new

concepts.
Scenarios usually envision a situation or a chain of events, often in the form of a story, in which the context, characters and events are depicted both to express and discuss the interaction among people and the design suggestion. It's important to notice though that scenarios are being used in different contexts for different purposes (See for example [4] [9]).

The earlier stages (websites, materials of the cards and the action packs) have brought up different topics suitable to be explored with new scenarios. In order to start the process, we use a set of abstract concepts and three-dimensional elements. This set aims at helping to envision the new scenarios as we go along and to propose new applications while telling a certain story. The pieces represent both the "real world" (people, places, objects) and the "digital world". Roles, spaces, behaviors, qualities, and activities, that are acted out by the elements can change place, illustrate complicated issues and elicit conflicting points. At a certain point in the process one can point out questions like: Who knows/sees this now? Whom I will like to give access to this information? And so on.

These "playing elements" are tried out in a "design session" initially only among the researchers. Here we test the components and play out how a particular imagined application could be achieved. After that, we plan a workshop where we present the basic idea (some context is provided but more in terms of possibilities) to some members of the community and they are encouraged to contribute from their perspective. It seems that presented in this way the scenarios are discussed in a more open way. The different components become a source of inspiration that provoke the people (community members and researchers) to collaborate, participate and design.

Applications and application patterns

A starting point of our research and design is to consciously focus on the things people want to do, achieve or change with the technology – the "application" – and on what kinds of designs and ecosystems of designs can help in realizing these needs.

We use the term "application" to refer to this focus of interest, because we feel it is understood reasonably well by the technology development community, who can easily see that "buying tickets through a web service" is an application of specific information technologies. At the same time, we acknowledge that the term is obscure for many other communities, for example to end users or social scientists. We hope that further work help us to develop a better set of concepts and terms.

As we tried to find ways to describe and classify applications and make our findings useful for development purposes, we came up with the idea of trying to apply the idea of design patterns to the analysis of applications – to search for "application patterns".

The original idea of design patterns comes from the field of architecture [1]. Today it has become a very vivid topic of interest in the software engineering community. In this sense the Design patterns describe patterns of functionality and features that appear in different circumstances and which can be reused in new contexts. We believe that the idea of reusable patterns, which apparently has been found to be useful in describing in a structured but fairly high level way how tools should function, will also be useful for describing how people do things

For the purposes of our work we try to formulate application patterns in terms of identifying different holistic **applications** that a person (or community) is interested in achieving. For example "being informed about the latest news" can be considered an application. In order to fulfil this need or interest, someone will make use of different **patterns.** For instance: she will watch the 8 p.m. news, or listen to the radio on her way home, maybe she discusses the news with another person, maybe she even uses a combination of all. These possibilities can be considered the different patterns that form up an application pattern. In such a structure a pattern can make up or be part of different applications, and possibly become reusable components.

By identifying interesting applications in the communities we want to study, which components and aspects they find important? What other patterns could they use and how? These aspects are important for us because we would like to find ways to separate the more general "application" (being informed about the latest news) from the more specific patterns (8 p.m. news at home and the other possibilities) and from the different solutions and tools available for the same application (watching news from TV or reading a newspaper).

This distinction might help us to distance the discussion from the specific features of the technology or tools to a slightly more abstracted and thus higher level, and focus more on the reasons and qualities that relate to choosing between alternative possibilities. Another benefit we hope to achieve with this is to make space in the discussion for the new features and characteristics of future tools that we cannot show or experience yet.

APPLICATION PATTERNS APPLIED TO A CASE:

Changing patterns of growing old, Active senior community

The lengthened amount of expected active years after retirement (called the third age) and the simultaneous crisis in state-led senior care have brought up questions about alternative ways of "growing old". The active seniors of our case excellently project the desires as well as the fears of what it is to deal with these questions. In taking the matters into their own hands, the active seniors are pursuing both a more independent but also a truly communal way of growing old. Zygmunt Bauman [3] has predicted that the state will lose some of its powerful position and the society's importance will continuously diminish. He sees grassroots communities as the vehicle for creating more options to the prevailing supply. These imagined communities, habitats, based on voluntary affiliations, which are negotiated continuously, form the postmodern society. Affiliation is produced by adopting symbolic markers, which are continuously searched for and adopted if a certain guarantee is granted (ensured by experts or popular by massive adaptation) New forms of social collectivity are taking root, which challenge our established modes of politics and tradition [10]. These communities are not usually authorized by the large quantity of members and not necessarily by durable goals (and they are fragile in this sense) [3], but they are cultures of sentiment and aestheticisation, which Michel Maffesoli argues are 'trans-political', distinctly disengaged from the political and returning to 'local ethics', or an 'empathetic sociality'. [10]

The idea of a new kind of senior housing (of the active seniors) was born in leisurely meetings among a couple of old friends. In the beginning the discussion circled around a more friendly (or fun), secure and humane place to spend one's retirement than what can be offered by the institutionalized senior homes or the (lonely) apartment far away from friends and family. The project has then inspired many more and has generated a lot of media coverage. The interest lies especially in the alternative, communal living arrangements for senior citizens.

Themes essential to senior care have been listed below and then linked to the idea of application patterns. The suggestion is to combine the different elements (security, community, nurture, independence, fragility = the applications themes) that are important to a holistic senior care, with the various possible (digital) schemas of how to address them (=patterns), and the objective that we try to reach in developing shared design tools (community driven design).

Here the issues are presented on a rough level, though a more detailed level is possible once the elements are more specified.

Community - In the case of the active seniors, the process seems to encompass two phases, the time before the house is built which is limited; and then the time of living in the house. In the first phase the different patterns should aim at shaping, strengthening and pluralizing the community. At this point even basic web-based tools are of a great support. A portal or an equivalent, a gathering place for a geographically spread out community, making the unknown known and trustworthy.

A place where discussions, opinions, plans and (dis) agreements are maintained, creating history for the community. The problem (the application) then can be stated as how is a spread out community created? Bringing forth the elements needed for it's localized sequel. The pattern (although there are several others, like regular meetings, community-workshops, trips) here revolves around the web-based tools.

Nurture - In the second phase the community will have formed and the digital tools should facilitate everyday life. Simple but critical issues like automating and remembering systems - the application- can help routines. A shared memory for the community remembers the personal and the common, the practical and the abstract. It keeps track of the relationships with outsiders (producers of needed goods, cooperative partners, maintenance teams, building companies). The questions inherent in these relationships: Who knows whom? Who can you trust to take care of your things? Where to buy the best or cheapest produce? And the solutions to these questions form the bonds and the many-layered digital networks. Digital networks allow cooperation that is not based on physical proximity (an obstacle for some), but will nonetheless enable working relationships and produce new ways of collaboration in the neighborhoods and other localities. The application here being: how does a group of individuals get through an average day in the web of interactions and routines.

Security A lot of special questions arise from the fact that this is a house designed for aging residents (taking care of themselves). From our earlier studies we know that the questions about security create a lot of polemic. How much surveillance does people want? Who does it? Who's allowed to watch? The users define the boundaries between private and public - they should be able to create the application and have the power to exercise such decisions in very flexible ways, under their own control. , I t has also become evident that the application cannot be solved by a single “product” but by the interrelations of diverse components in an ecosystem.

Independence Questions about independence are related to both the community and the age. How can independence be aided in old age? Digital systems allow various different versions of publicity in various matters and varied personal solutions. Although the community will make some joint decisions, all the individuals have to consider their perception of the private/public dichotomy in the community.

Fragility (mental and physical) A digital system can hold personal recollections, memories recorded and recommendations from friends as well as it can be the place where documents of the highlights of the communal life are posted. By digitally enabling them to remember (both by recording memories and developing reminders) and assisting them on the routines of everyday health issues, some of the obstacles to living at home are conquered. Such possibilities have become more visible when the scenarios are played out in an open way with the pieces during the sessions. .

CONCLUSIONS

This has been an approach to describe the goals, methods and working examples of our current work. A lot of the concepts and ideas are very much under construction, therefore this should be considered more like an introduction to the themes we are working with than an actual report of results.

Our purpose is to generate design within collaborative work with communities through long-term relationships and mutual commitments. This creates a need for developing methods that support and produce ways of enabling the production of ideas. It seems that people are interested in discussing areas in which they have personal interest. For this reason the discussion process should be such that it supports an open exchange of ideas. The communities take an interest in influencing the possible designs if they feel like their opinions matter, if they think that they are an integral part of the process. Provided that they feel inspired, see a connection to their everyday life experience and find productive ways of communicating, ideas start to emerge. We have been gladly surprised by the amount of ideas that the sessions are generating. Identifying a convenient level of discussion remains a central point in both the contextual stages as well as in the design sessions.

The context has helped to identify the multidimensionality of the issues that need to be addressed. There is a clear need for a reflective atmosphere. In this sense the scenarios should support ways of emphasising both their positive and negative possibilities in order to discuss the trade-offs. We hope to continue developing the idea of the application patterns as a focus to help us avoid concentrating only on devices.

We still need to experiment with ways and formats to avoid relying on people's predefined ideas about what technology can do. Short-term pilots and more concrete prototypes are the next step to create more inspiration and produce more spaces for dialogue.

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Readymade design at an Intensive Care Unit

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ABSTRACT
Marcel Duchamp invented the idea of using existing artifacts as art objects by recreating their meaning. These artifacts he called readymades. This article uses his ideas about readymades and applies them on a design project at an intensive care unit. Through negotiation with the staff and among the staff themselves the meaning of already existing artifacts was co-constructed, transforming them into educational tools in their daily work. Self-produced videos accessible through barcodes out in the context and viewed on handheld computers support their ongoing oral learning culture and function as a common point of reference where their work practice is negotiated.

Keywords
Healthcare, work place learning, self-produced contextual video, handheld computers, readymade design.

INTRODUCTION
The story told is not the story of how a new artifact was designed. Instead it is the story of readymade design where new images of how established artifacts were reconstructed to create a new setting for learning at an Intensive Care Unit at the University Hospital in Malmö. We will tell how the staff at the Intensive Care Unit co-constructed images of their work practice through self-produced video and how this could support learning at their work. Kathryn Henderson has shown how engineer sketches facilitated individual thinking as well as collaborative communication. These drawings, that she terms conscriptions devices, function as network organizing devices letting different actors co-construct meaning when working toward a common goal [5]. Similarly the self-produced videos facilitated individual as well as a group thinking at the intensive care unit.

Working in the participatory design (PD) tradition, but with a background in Fine Art, for us the idea of co-constructing has its roots in Marcel Duchamp. Already in 1914 Marcel Duchamp famously exhibited a bottle dryer introducing the concept of readymade or "found" object. Instead of creating a new art object he pointed out an existing artifact as an art object. One of the many implications of the work was that the object's meaning could be reconstructed through mental constructions, which further implied that meaning to a large degree was created mentally in the meeting with outer sensations. Meaning did not reside fully in outer sensation but in the meeting with them in a social context. One implication was that the viewers of the art object always reconstruct its meaning. Another implication was that the context, which an object is placed in, is significant to how the object is understood. Duchamp, however, did not mean that objects themselves were exempt from meaning. In fact Duchamp believed that the art object contained not only the artist's intentions but also contained meaning that she or he is unaware of putting into the object. The unintended content is hidden to the artist and is not revealed until the work enters into the social space and is read by viewers [3]. Similarly Hartswood et al. argue that use itself provides a significant source for design, but participatory design processes have seldom moved beyond the point of development and implementation where user expertise becomes most valuable [4]. According to Duchamp the creative act happens in the meeting with the object where the different intentions both conscious and unconscious are revealed. The gap between the intentions opens up and allows for a creative space to be established. This creative space is under constant configuration as posterity reconstructs its meaning [3].

THE INTENSIVE CARE UNIT
Our inquiries at the intensive care unit were on critical care nursing of the patients with a focus on the employees' work practice learning. After some time and through continuous analyses several strong images appeared. We saw that the intensive care unit had a dynamic workplace milieu with ongoing changes and vast variations in tempo. Most of the time the patient rooms were under constant configuration: patients entering and leaving, medical equipment being shuffled around, the staff going on or off

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their five hour shifts, relatives visiting and experts from other units inspecting patients. However, in spite of all these activities the atmosphere was most often calm. Only once in a while the tempo would intensify or drop down to a low level of activity. The shifting nature of the work fascinated but also distressed the staff. The fascination was that they never knew what met them when arriving at work, i.e., what type of patients they would be treating and what skills that would require. What they found disturbing on the other hand were all the new routines, which they found difficult to be updated on. The new routines demanded that they had to continually rethink their work. Despite the information overload caused by constant new information the staff seemed content with their dynamic work.

Fig. 1: The staff stated that they preferred learning that was closely connected to real cases in their daily work. The daily learning built strongly on an oral culture.

We detected that the dynamics of their work required an immense ongoing learning activity. A lot of the learning was closely related to their daily work, which built strongly on an oral culture. The oral culture was manifested in several ways. When confronted with a task they were unsure of how to perform the staff would rely upon each other for assistance to talk through the problem, solving it together. The solving of problems together were rich learning moments of negotiation through show and tell. The drawback of the oral culture was that routines could easily become distorted. The distortion can start out with one person doing a task slightly incorrectly. A colleague then picks up the inaccuracy and before long a routine has been altered. It was therefore important to have reliable sources of information so that routines are not distorted. Despite the drawbacks the oral culture was appreciated and considered important allowing the staff to socialize and exchange ideas.

Sustaining tradition through a common point of reference

For Duchamp the creative act happens when different intentions are revealed in the meeting with an object. The object becomes a common reference point for the artists and all those who enter into a dialogue with it. Playing metaphor games constructed by us for workshops revealed that the staff highly valued an artifact that functioned as a common point of reference. One example was a newspaper in one of those games considered an important artifact because it sustained tradition and motivated people to discuss. It seemed, however, to be unclear what the unit's common point of reference was.

A central issue in work place learning is the exchange of experience. Benner has observed how nurses learn through what she calls personal paradigm cases, which are situations that are both clinically and ethically demanding. These exceptional situations model the nurse's future work practice [1]. Similarly Orr has observed how technicians of copy machines exchange stories of complex repair cases. These war stories are central in developing the technicians work practice by becoming part of the community memory [9]. What Orr acknowledges is that learning is a social process and that experience and memory are spread among the community members. Lave and Wenger (1991) state that a work practice evolves more through the form of organizing the community than the rules of the practice. The form of collaboration is important because it affects the way the community can negotiate what competent practice is. Competent practice is not a stable solid core; instead competence has a relational character demanding ongoing negotiation of meaning [7]. These negotiations occur when the community members exchange experience through doing the practice together as well as exchanging stories. The staff felt that they had within their community in their daily work a lot of experience that could be better taken care of. The occasions for exchanging experience had diminished and the forms of exchange could function better.

SELF-PRODUCED VIDEO

After several design workshops the staff and designers decided that the most fruitful direction to further investigate was if video could be used to support the ongoing oral learning culture and to do that some video material was needed. The first movies made were short instructional movies about different medical equipment that were considered difficult to use. Making the movies was intriguing because it revealed that the staff effortlessly and without preparation made excellent movies. We basically just held up the camera and the staff with their prior knowledge could spontaneously be filmed instructing their colleagues. The strong tradition of orally informing each other became apparent. The film sessions talked strongly back to us that the video medium could be a useful resource for their practice.

When the films were presented the staff was enthusiastic. It was much better to see a colleague show and tell than read a written instruction. They wanted, however, to be able to see the films out in the work context. This corresponded to what we had seen in previous design workshops were the ability to make information available on small displays out in the context through barcodes or other tag technology was considered interesting. Therefore we decided to bring together the two ideas. Passarge and Binder (1996) have experimented with video for learning on a laser disc out in the work context [10]. With today's handheld computer technology available maybe it would be even easier to make the video accessible out in the context. The collaboration resulted in a design proposal, where self-produced instruction videos were made accessible on handheld computers through barcodes out in the context.

Fig.2: Self-produced videos were made accessible in the work context supporting their oral learning culture.

We did not know if the suggested design solution would work. With Duchamp's ideas in our mind that an artifact resists and reveals parts of its meaning first after it's placed in a situation we confronted the staff with a handheld computer containing video made at the unit. We asked a nurse that had never used a particular machine if she, with only the support of a video played in a handheld computer, could assemble it. One of the questions was if the small display of the handheld computer would suffice supporting the task? It turned out that it worked well. However, what was most interesting with the experiment was how much she valued listening to her colleague's voice which made her feel secure when carrying out the task.

NEGOTIATING PRACTICE BY MAKING AND WATCHING FILM

The challenges in front of us at this stage were to domesticate the process of making films and using films as part of the daily learning rather than technically implement the concept. The staff among themselves needed to explore in what way self-made video films could be meaningful for them.

Julian Orr has pointed out that technology does not explicitly have inherent meaning. Technology needs to be socialized in a way where relationship is honored [8]. Williams et al. (2000) say that to domesticate an artifact is to negotiate its meaning and practice [11]. For an artifact to be domesticated it needs a facilitator, i.e., someone that can show how it can be used in a meaningful way. Its usefulness is shown through use and repertoires of good examples where its use and meaning are negotiated. In terms of Duchamp the creative act happens when an artifact enters the public arena and its meaning is continuously negotiated rather than when the artifact is being "produced."

Fig.3: The production of movies was an opportunity for learning in itself. The learning occasions were along the whole process of making the movies as well as when they were made available to all staff members.

A rich setting for learning was established from the very beginning of the film production process but this became apparent first when we stopped acting as cameramen. The filming of the movies became a lot more interesting when two colleagues worked together. The making of the films became a rich learning occasion allowing the staff members to discuss and reflect on their practice as well as check how certain unusual procedures are done. This observation is similar to what Binder noticed when making educational movies in collaboration with coil setters [2]. The staff at the intensive care unit reflected on a whole range of issues such as what they had trouble with at work and why that was the case, what was important to include in the films, what kind of language was practiced at the unit, as well as how they should communicate and teach. Often the process of making movies started out with two individuals making a “rough draft” movie with the intention of adjusting it through group participation. The movies functioned, it could be argued, as conscription devices in a collaborative visual thinking process establishing a space for negotiation [5].

The reflection and negotiation of work practice with the films as reference point continued after the initial filming was done. The making of the movies was typically a collective process not only involving the instructor and the cameraman but also involving a large number of staff members watching the movies and commenting upon them. To get feedback on the movies frequent film presentations were established in the intensive care library. The film presentations involved five to ten staff members that were asked to comment upon the movies. Did the movies include all that was needed, was anything incorrectly stated, was there any aspect that needed to be stated more clearly?

Generally the movies were considered to be of good quality and they appreciated that it was a colleague's story that they heard in them. They were surprised that their colleagues were able to make such good movies. The movies were judged to be much better than corresponding movies from manufacturers of medical equipment. This was partly due to the fact that the films were judged by their community to be a known successful reading of how a certain task was accomplished. Seeing several good examples of film helped to them establish the picture that they are capable, without too much difficulty, to make quality movies.

The film presentations functioned also as positive feedback recognizing good practice. But more importantly the presentations were an opportunity to reflect and gain insight into how their colleagues practiced their work and how that differed from their own practice as well as how it differed in some cases from the prescribed method. The difference that was revealed by watching the films collectively spurred discussion on how certain procedures should be done. Why should I do it this way when another way in my opinion is just as good? The movies function as mirrors of the practice and often had the character of an investigative film. These qualities of video are similar to the way video has been used as a research tool in ethnography and PD revealing tacit knowledge and creating a distance to the everyday work. Karasti (2001) has seen that video makes “taken for granted” aspects of work visible and therefore easier to reflect on when she has used video as a shared object in her work with Radiologists [6]. Even if the main purpose for the intensive care staff, when producing videos, was not to us as an ethnographic tool or to elucidate tacit knowledge, the videos nevertheless had qualities that allowed for this to take place. It also became clear that the learning not only would happen mainly on the receiving end of the peer-to-peer communication. The production of movies was an opportunity for learning in itself. The learning occasions were along the whole process of making the movies as well as when they were made available to all staff members.

The comments that came up during the film viewing lead in some cases to redoing the films completely and in some cases to appending sequences at the end of the movies with missing information. In one case an enrolled nurse redid her film since she had heard that her parts of her film had been questioned during a film presentation. Before the re-take she wanted those that had found parts of her movie unconvincing to clarify what they meant. A spontaneous viewing of her film in a video camera was arranged in an empty patient room. Two colleagues saw the movie with her commenting upon what they thought needed to be clarified**.** She in turn explained why a certain tape should be used and not another resulting in that they accepted her argument. After negotiating the content of the movie they directly filmed a new version of it.

Fig.4: Video as a reference point for discussion.

These instructional movies were not purely instructions movies and as stated earlier functioned well as a reference point for discussion. Some of the instruction movies had in fact more the character of a war story with an instructive message. A good example of such a war story is a movie that an enrolled nurse created. When she talked to us she told us that she wanted to make a movie about how a piece of board is removed from the patient bed that is difficult to remove. When the movie was made the point of the movie became clear. It was not simply an instruction to her colleagues about how to detach the board. The message was: "I think we should clean the beds more often. To do that the board has to be unfastened and this is how you do it!" Another example is how an instruction movie unintentionally became a war story used for negotiating the possibility to buy new equipment. Preceding a film presentation one of the unit's physiotherapists had voiced the need to buy a new model of certain medical equipment without getting much response from the senior physician. She had voiced the need because the new model was less complicated to use. Once the senior physician had seen how complicated the current equipment was at the film presentation he recognized the need to take the physiotherapists' wish into consideration. In this case the film not only functioned as an instruction movie but also as a negotiation film.

CONCLUSION

If we look back at the process and ask ourselves what we have designed it turns out that it's not the handheld computer of course, and it's not the barcode reader, or the idea of using contextual information; nor has any software been designed. All the artifacts and software are off the shelf and already exist and yet something has been designed. What we have done together with the staff at the intensive care unit is to use off the shelf products as ready-mades reconstructing their meaning.

Letting the design process continue into use has broadened the suggested design solution. Instead of being about contextual video instructions it has evolved into a learning process using video as reference point. The process starts when two colleagues discuss and negotiate how the film should be made. It continues by involving additional colleagues in watching, reflecting and discussing their work practice. The objective of producing films to be viewed in a handheld computer is nevertheless intact, but has been reduced to being just one component in a larger process.

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Aligning Design and Technology Infrastructures for a Collaborative Workplace: Considerations in Architecture and Design Practice

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ABSTRACT
How may design address the conditions of change and creativity in today's workplace environment, particularly in large (200+) organizations?

Based on investigations of workplace designs for high technology companies, this research project supports the notion that in order to develop effective workplaces, architecture and related design professions not only need to respond to the physical requirements at hand but also need to expand on the role of individual users, supporting technologies and factor in the changing nature of the work space itself.

The paper reports on findings of two case studies that represent conventional design workflows in workplace design. Based on these findings, the paper proposes key criteria for the development of an alternative design model where users could increase their level of participation in the design process and shape their environments within parameters of a negotiated framework. The paper describes opportunities where this multidisciplinary approach could be taken to facilitate for direct and meaningful exchange of creative ideas, knowledge, and physical resources between all project participants and also illustrates an emerging model of workplace design that can leverage technology investments for design benefit and user collaboration in today's increasingly networked office.

Keywords
Design Process, Architecture, Design Collaboration, Workplace Design, Space Planning

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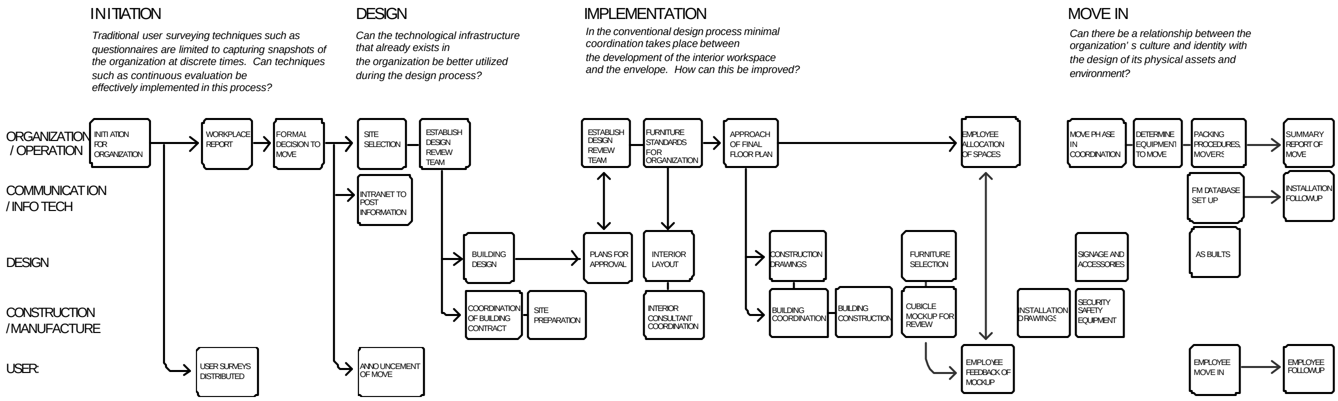
OVERVIEW: CASE STUDIES, USER EVALUATIONS AND EXISTING DESIGN CONVENTIONS

The ideas underlying this investigation were initiated by the motivation to develop more effective means for the physical design of workplaces. How could some of the characteristics traditionally valued in architecture – as an activity to stimulate creative thought, facilitate for social interaction and to solve problems through collaboration - be best leveraged in today's high technology workplaces? The findings from investigations of two software development companies have led to the emergence of an alternative design model for the workplace. These findings are a result of the academic study of *DSP* and *Company C* [1]. Both of these companies utilized user surveys, interviews, and focus groups that characterize the preliminary stages of development for what could be described as a conventional workplace design approach [2].

Figure 1 illustrates the design approach taken by these case studies, which reflect established workplace design processes [3]. This approach leads to one understanding of requirements within a static time frame and does not incorporate changes after the implementation of a design. For the design of *Company C's* facility, for instance, it was found that even after undertaking user evaluation and mockups, the final outcome of the workplace layout was a design that was implemented uniformly throughout the building. The investigation found that the result had less to do with lack of motivation for a more innovative solution than with the mechanics of the design process itself. There was intention on the part of designers, suppliers and the organization to work towards an imaginative solution but the resulting workstation configuration was by and large limited in its flexibility. The interior requirements will undergo constant adjustment during its life cycle as company projects and employees come and go. The workplace design will therefore be more effective if it incorporates a framework that can accommodate both specific parameters as well as programmatic indeterminacy.

Figure 1. This chart diagrams the participants and some of their roles in the design process. The conventional approach is characterized by a linear decision making process and efficient implementation for fast track schedules.



Many of the evaluation techniques such as surveys and interviews utilized in conventional design models emphasize strictly technical and empirical approaches. As a result, they leave little room to elaborate on less specific design attributes or unexpected needs. These traditional survey methods limit the level of design discussion and communication exchanges between the users and the designers. Minimal user engagement in the process of evaluating and designing the workplace leads to a level of acceptance of the status quo by employees.

Another limitation is the separation between technology infrastructures and the physical design strategies. In many instances, technologies relating to the organization's core competencies are being implemented in the new workplace. Advances in monitoring systems, computer facilities management and network infrastructures have been introduced in many high technology office environments. For example, *Company C* has acquired facilities management software and with their in-house skills, has re-programmed their specific needs into the application [4]. In addition, in both case studies, user mobility within the office environment has been increased as information technology departments consider the implementation of wireless technology solutions. There is no doubt as to the effect these technologies have on the spatial aspects of the office, yet the physical design has minimal consideration of aspects such as the relationship between wireless technologies and user interaction.

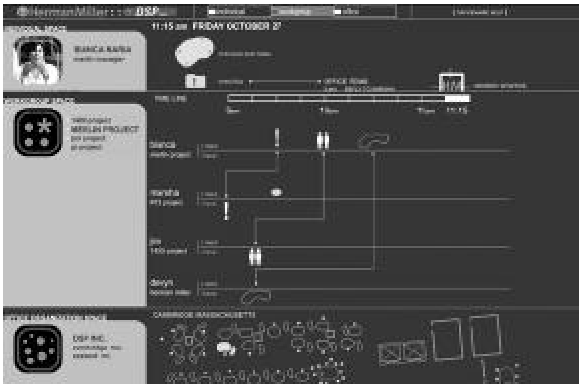
In most aspects the impact of forces outside of physical aspects of environments and objects has remained unexplored in architectural design. Examining the intersection between user interactions, organizational aspects and physical space will have a significant impact on the design of new or existing workplaces. The challenge emerges: how to identify specific issues and situate them in existing design processes in order for architects and designers to rethink the design of high technology office environments.

TOWARDS AN ALTERNATIVE DESIGN MODEL FOR WORKPLACE DESIGN

Developing key factors that are critical towards incorporating computer-assisted technologies for better design outcomes have been one of the main aspects of this investigation. Software applications, typically seen as a tool that is separate from the physical environment, have the potential to not only facilitate for functional processes but also mediate to actively promote design innovation within the organization. The objective of the investigation is to develop an approach to provide for an effective interface between the organization, the individuals and designers. This approach could also improve over traditional user surveys in soliciting data through both manual and automatic input and be more effective as an incremental development technique that yields designs to respond to changing needs of the office space.

This premise provides the basis for an ongoing academic design project that has been undertaken as a response to the workplace investigations [5]. This project is called *Officeware* and is an office design concept that incorporates software, furniture, and communication-collaboration between users, designers and an enlightened facilities management. In addition to outlining key design criteria, several design concepts from the *Officeware* project are illustrated in this paper.

Figure 2. *Officeware* is the interface that mediates the physical environment with user communication.



1) Developing Communication Tools to Cultivate a Design Community for Users and Providers

Effective qualitative approaches need to be developed where user experience can be documented in a manner that traditional methods such as manual surveying and marketing-centered techniques cannot provide. The development of a communications platform to effectively map exchanges of ideas generated by large numbers of participants to visually analyze the process, show consensus and collective support or dissatisfaction when a design move is needed. This communications tool could mediate information exchanges between individual workers involved in various design activities within the project group, within the larger office, as well as provide a platform to visually explain such exchanges and needs to the facilities management and the designer.

The role of communications media can be an important contributor to the process of designing an office space. Successful communication in design, for instance, could result from the increase in scope and complexity of the design product as a result of the benefit from resources of multiple inputs and expertise. The communications tool could be embedded within existing information technology infrastructures that are already in place for managing and maintaining building and physical assets within the organization. This integrated systems approach could address pragmatic and design issues of various specificities.

In order for this technique to be effective, the presentation of choices that are provided to the users should be associated with how they organize their daily habits in the workplace. This framework could allow the user to change their work style to a larger degree without raising undue inconvenience. The decision-making can begin as a reflective action [6]: why do I do this in this space, why do I like that about the office, how are others doing it as well? For instance, people often interpret their workspaces and give it meaning through the uses and rituals that accompany the objects they use daily. This has a value in mapping people's relationships to the objects in order to provide a context in which the objects are used. This approach benefits the design of environments and interactions based on forming experiences that unfold over a longer period of time.

New representations are needed to partially function as graphic tools to diagram as much as possible these design and decision-making processes. These representations need to effectively document the flow and exchanges of the ideas generated by a large number of participants but also visually analyze the process, show consensus and collective support or dissatisfaction with a design move. The development of the temporal aspect in the representations will allow for the construction of narratives while leaving visible the possibility of change.

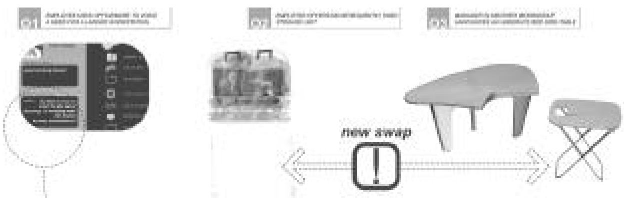
2) Tracking Movement in the Workplace

Figure 3. Automated process to measure space utilization of public zones of office spaces. The results can be used to assess how different designs prohibit or induce movement or can measure the effectiveness of a new design compared to the previous one.

An integral part in the *Officeware* project is the making of a digital environment that can systematically capture informational knowledge [7]. This can be done through tracking movement and usage patterns in order to provide empirical information to better assist the evaluation of a spatial layout as it was designed and constructed. This technical component plays an important role in this method because they minimize the human effort required to collect the data. And obtaining objective and timely data were significant conclusions that arose from our workplace research. Furthermore, by mediating communication through a computer interface, a certain level of information related to design issues of the office could be formalized. This can further reinforce the notion of design as a relational activity that could affect larger scales of architecture, and the integration of the building and the surrounding environment.

3) Continuous Design and Prototyping

Figure 4: Integration of software interface, user participation and furniture testing



In developing a new design strategy, the concept of continuous prototyping needs to be incorporated to respond to various design problems that occur in the office. This approach increases the possibilities for achieving results through the utilization of iterative prototype development while potentially minimizing time taken off the user's work obligations. This collective 'brainstorming' results in an increased chance of developing options that are novel and useful. In addition, ideas that might seem wild, unrelated or useless at first can function as springboards for future projects.

A mass customization approach is required to take advantage of these material developments and for assembling individual products and services to meet the unique needs of users at a similar cost to a mass-produced product. By integrating with the computer-assisted communications system, users and designers can work together to assemble products to meet specific and individual requirements while reducing lead times, costs and delivery. Over time, the products can be amended so that they continue to meet changing needs and continue to reinforce the relationships between the user and the designer. The implementation of the mass customization approach requires a revising of the existing working contract between the organization, the designer and the manufacturers. There needs to be commitment by the organization to allow the designer to establish a long-term collaboration with the organization. Through this process certain innovations can be made from interplay between the various participants of the collaboration.

Ultimately, the initial programmatic requirements should be given less emphasis in the development of the workplace design. Instead, the focus should be on developing a tactical strategy that can benefit from the accumulation of individual design interventions that occur throughout the life cycle of the office (30+ years). This obviously must be achieved in both an efficient and innovative manner, while at the same time maintaining a relatively stable corporate and aesthetic identity of the organization. The underlying principle of ongoing indeterminacy as a basis of designing interventions allows shifts, modifications to unforeseen events and strategies for change to occur without creating chaotic environments.

4) Committing to Ongoing Collaboration

New strategies are needed to consider the level of investment designers and manufacturers make in committing to an ongoing collaboration. Techniques need to be established to provide for continuous reevaluation of design interventions and results. The designer in turn could monitor the spatial organization and performance of the company and could make adjustments and improvements as new conditions occur. The computer-assisted interface could therefore be further developed as a mediation device for managing more directly and efficiently the physical and communication aspects of the work environment for both the client and the designer. In addition, by involving users in the ongoing design process, improvements can be made towards the chances of success in the office design.

The approach is one that is participatory, collaborative and ongoing: the result potentially could be the workplace as a catalyst for transforming the work organization, engaging the user as part of a cooperative development environment, and potentially changing the very nature of work in their respective fields.

SUMMARY

Can a building promote creativity? Creativity needs an elusive dosage of order and chaos, fixity and improvisation.
Rem Koolhaas [8]

The development of an alternative framework for designing the workplace acknowledges the fact that the office is an intersection of conflicting and complimentary interests. This framework allows for a design community to emerge between the users, the management, and "outside designers" and to formulate their own common language. Specifically, one of the aims is to provide a scalable approach that can be implemented incrementally over time. The strategy attempts to encourage the involvement of the purchasers, the individual managers and the users themselves for the benefit of all participants. The benefits for the organization include the idea that the integrity of the corporate identity can be maintained while individual choice is being cultivated. From the project manager's perspective, the infrastructure can assist in developing informal networks that can improve the quality of the environment while maintaining formal work-related activities. From the user's perspective, new opportunities can be developed across a range of individual and collective activities, from improving communication exchanges between other users to providing the ability to design more effective work environments. And by reducing the layers of management, the design community can bring new energy and creative collaboration to the office that can lead to a more fluid design environment minimizing provider/user barriers.

The key design criteria that have been presented in this paper support the integration of building data, visualization and communication to assist design decisions. An important challenge in this collaborative approach is the need to develop a set of digital tools that can accommodate for uncertainties and complexities. In addition, long-term collaborative design projects require maintenance and the willingness on the part of the users to commit to using the system. The various social boundaries that exist in the multi-party collaboration need to be continuously renegotiated. This area is the focus of research activity in information systems and remote collaboration; it needs to be considered a critical issue within the architectural design community with significant potential benefit for the profession.

Does this mean that spatial planning of physical layouts is no longer relevant in the new workplace? Planning will be required for establishing guidelines and managing the larger relationships between the organization and the individual users. What is needed is a spatial planning model that augments the present one, which is based on dominantly functional connections. An infrastructure is required that makes use of the individual within the collective and is also capable of facilitating cultural as well as functional negotiations. In addition, it must be reiterated that this is not a deterministic approach that automatically determines decisions, but instead suggests a method to immediately communicate with the users and the management so that design professionals can collaborate with their clients and design timely and responsive furniture and work environments.

The idea of a more distributed spatial planning approach is closely related to the concept of the networked community of the organization. The new culture of work is ideally the culture of meaningful interactive communication between knowledge and place. While an explicit structure is still required, the design approach needs to transform from a rigid to a more flexible strategy, and to a negotiable set of tools utilizing various components that provide a blueprint for the various work group constituents throughout the work organization. The role of the architect in this networked design process is to become a facilitator directing the ongoing evolution of the office space.

This ongoing research investigation follows the notion of empowering the user in the design of offices. The overall strategy of this design framework is that the design process does not end after the initial implementation of the office layout but rather integrates design interventions that occur throughout the life of the organization. Design in this case is considered a constantly changing entity that could better satisfy the many complex factors of the office when it is considered as a cooperative, interactive and iterative development. The research aims to recognize the importance of an individual within the organization and provide facilities for him or her to actively collaborate with the designer in shaping the workplace environment.

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Trial-and-Error based Innovation: Physical Iteration Games as Collaborative Strategy in Product Design

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ABSTRACT

Phenomenology opens for seeing mind and body as inseparable in design action. Scandinavian researchers have shown that such an anti-dualistic approach to design is facilitated by employment of physicality as a communication tool. This participatory action research project is arranged to explore the potentials of using Rapid Prototyping (RP)-produced physicality as a tool for the facilitation of creative collaboration between dissimilar stakeholders of design teams. It is found that product design procedures can be supported by RP technology in iterative patterns, which seem to catalyse 'mind/body experiences' and understanding of individual and integrated contributions to the totality. Such 'physical iteration games' are integrated in the 'language games' we play in design, in procedures where 'sense-based' and 'word-based' languages of the actors seem to merge. Two concrete design research projects will be described and the findings elaborated.

Keywords Collaborative design, Rapid Prototyping, Iteration

Rapid Prototyping (RP) technology, also called Layer Manufacturing, is based upon fast, cheap and accurate materialisation of (virtual) 3D CAD models in different materials and techniques [9]. The technology has in a few years revolutionized the phase of product design procedures where a finished concept is to be modelled and evaluated – traditionally called *prototyping* [14]. This project focuses on earlier and later design phases.

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Approaching real life complexity

Cross et al. [5] describe how early design process models were based in engineering design of deterministic and mechanistic structures: prescriptive, rational, linear, algorithmic, theoretical and problem focused. These were criticised by design methodologists in the early nineteen seventies, who suggested radically changed models of practical structures: descriptive, intuitive, cyclic, heuristic, empirical and solution focused – based upon tacit knowledge and 'primary generators' [6]. After 30 years of opposed approaches, a distinct tendency today is to see product design processes in contexts of real life complexity where not only the integrated efforts of engineers and industrial designers are called for, but where several actors of diverse disciplinary background together with future users must learn how to collaborate [16]. Traditional design methodology approaches complexity through *reduction*, which may function well in contexts of redesign of well known premises, but for the purpose of eliciting collaborative and creative efforts between dissimilar actors with different values, norms, cultural backgrounds and preferences, recent design research trends indicate a need for new ways of understanding such realities [21].

Since Enlightenment, science has regarded the human mind as 'subjective'- incapable of 'objectivity'- and therefore untrustworthy. But since personal engagement, abilities and emotions are preconditions for creativity [17, 11], the elimination of the subjective realm in research on design action does not give meaning. The challenge then becomes to approach design from a position of mind *and* body interaction. But we seem to lack basic understanding of creative action with subjective involvement in integrated wholes, and if one subject shall be understood in his/her mind/body totality – how shall several subjects trying to coordinate dissimilar subjective values (and rational knowledge) in shared objective action be approached? For the assessment of these difficult questions I have chosen to depart from the action itself – and from a phenomenological perspective.

Husserl rejects the Cartesian dualistic separation between the objective world as it is in itself and the subjective world as it appears to the individual. The objective world to him is the outer stage for human 'intentional acts', which are essential elements of our 'lifeworlds'. Direct and immediate experience of phenomena in the world presupposes such intentional acts where sense perceptions like seeing, touching and smelling serve as formative elements [12]. A phenomenological approach to research thereby becomes not only to describe a matter as it appears as experienced object, but also to describe the experience of the object. Such a humanly experienced lifeworld is neither purely objective nor purely subjective [22].

I will call an experience perceived through the human senses according to this line of thought a 'mind/body experience'. Phenomenology has inspired a number of Scandinavian researchers to approach collaborative design through the employment of *tools* with preconditions for elicitation of shared mind/body experiences. I have selected three representatives: Ehn, Brandt and Lerdahl.

Research on communication tools

Ehn [8] draws inspiration from Husserl's successor Heidegger and focuses his distinction between two important positions for understanding practical artefacts; they can be either 'ready-to-hand' (*zuhanden* - a hammer is not an extended object to an acting carpenter) or they can be 'present-at-hand' (*vorhanden* - a hammer can be reflected upon also by a carpenter). Thereby use and understanding become different aspects of the same activity. But for theoretical reflection on design, ready-to-hand action must be made present-at-hand through 'breakdowns'. Thereby for instance users and designers can communicate on a background of understanding through creation of 'language games' described by Wittgenstein [19] where some shared language becomes the means for communication. For the facilitation of such games, Ehn suggests several approaches to 'design-by-doing' where different kinds of socially constructed artefacts serve as tools to facilitate the breakdown of ready-to-hand experiences – "because of the interaction and reflection they support" [8]. Such mock-ups express propositional knowledge and practical understanding through 'hands-on-experience'. They can be made from cardboard or simple available physical objects for 'ready-to-hand' use.

Brandt [1] elaborates further on these basic principles and stages 'event-driven product development' procedures where materialised representations of different kinds play a central role as communication tools and facilitate the communication between developers and users towards shared learning and understanding. Brandt and Grunnet [2] demonstrate how 'bodily approach' can be brought into user design procedures through the application of drama and props1 in the development of advanced electronic service tools. They focus props not only as 'things to think with' but also as 'things to act with' to gain shared real life understanding of all aspects of the emerging product concepts.

Similarly Lerdahl [11] approaches collaboration in design teams, but focuses procedures and models for elicitation of creativity in early project phases - where physicality and object relations play important roles in staging mind/body engagement of the participants. For instance in scenario plays aimed at creation of visions, employment of playgrounds and activity zones equipped with diverse physical artefacts for engagement and fun-making are central issues. He argues that creative collaboration preferably should take place on abstracted levels of interaction – and eventually proceed to material levels through alternations between abstractions and details.

These contributions have undoubtedly brought valuable insight into understanding of basic collaborative structures in design, where real life mind/body experiences are of central importance. But in product design, where the integration of frequently conflicting claims of diverse nature is of prime concern, it seems that their approaches could be extended into a landscape of higher *specificity* - and that innovative opportunities to a large extent also may emerge in later and more concrete stages of conceptualisation. Their chosen tools demonstrate convincing collaborative effects, but I find reason to ask whether the demonstrated tools alone are the most appropriate for bringing multiple desires all the way to negotiated solutions – of serving the giving-and-taking of opportunities, of playful experimentation with emerging possibilities, of trying and failing and trying again – not only in imagination, but through hands-on-experienced reality. I ask: To what extent may the RP tool possess inherent possibilities which can serve such aspirations – and thereby contribute to bringing collaborative design one step further towards realisation of *negotiated meaning* in design teams involving many dissimilar stakeholders?

Research on trial-and-error

This research project has been structured to assess these questions. Section A was organised as a case study project including Selective Laser Sintering (SLS) production of 339 rapid prototyped parts for 16 projects (mainly in polyamide) for four sponsoring manufacturing companies and five collaborative student projects, plus Rapid Tools (RT) for three companies. The parts were mainly used for testing of new product concepts and evaluation of technical, functional and aesthetical parameters. In a qualitative research process involving collaborative action, theoretical studies and reflections in the form of discussions and in-depth interviews, the collaborative potentials of the technology slowly emerged over a period of one year. We found that in conceptualisation, strength and accuracy of the produced parts is of moderate importance whereas high speed and low cost are highly important, and accordingly bought a very fast and cheap Concept Modeller from Z-Corp based on plaster and glue and primarily used this in section B. The researcher here followed a Participatory Action Research (PAR) regime where s/he submerges in the material as an active participant [15, 3]. Such research cannot produce value free findings, but local stories with potential for inter-subjective agreements. Two PAR projects with student participation in co-operation with two sponsoring manufacturing companies were now arranged to test and further evaluate the findings of section A: 1) a children's sledge concept based upon a balance principle (for Hamax A.S.) and 2) creative solutions to mouth hygiene (for Jordan A.S.). Video recordings were made of the collaborative meetings, 'soft quantification' schemes of chosen variables were completed to track down the advances, questionnaires were completed, and a process-oriented discussion was video taped. Relevant model material was photographed for documentation.

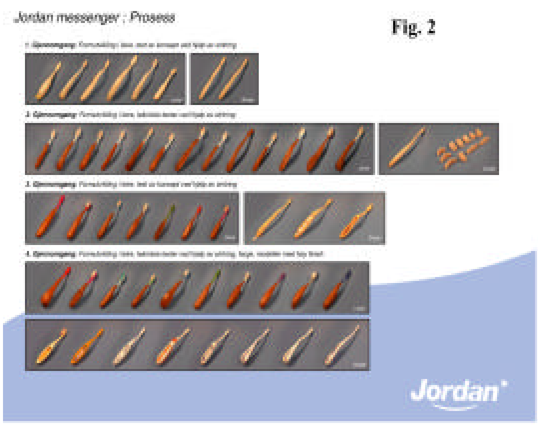
The balance sledge concept resulted from a two-stage student project. Hamax A.S. wanted to pursue the concept in an RP-supported project with the winning student as a designer in collaboration between four co-actors representing administration, market, engineering and design knowledge. First a steel mock-up was built and tested. Next a new concept was negotiated on a sketch level, designed as a 3D model, materialised as a concept model and negotiated. This procedure was repeated in four iterations with a new meeting for each iteration.

Figure 1 shows the four iterations where parameters like material strength, stiffness, bearing stresses, moulding properties, crash properties, curving functionality, turning properties, assembly properties, turning handle locking device, steel edge assembly, ergonomics, market image, aesthetics, production/ handling logistics, economics and sales policy were continuously being negotiated in each meeting. When changes in the models were agreed upon, they were simply added to the physical models with clay – and the result thereby represented the outline for the following iteration.

The mouth hygiene project resulted in five different designs of which Jordan A.S. decided to continue the development of three. The first phase was arranged as a

Fig.1

creativity course led by Erik Lerdahl, in accordance with [11]. Initial ideas were elaborated through RP supported concept modelling in four to seven consecutive iterations. For each iteration presentations and discussions were conducted in plenum sessions with representatives for market, engineering and professional design knowledge present. Only one design will be described here, the children's 'motivation brush', which was a collaborative project between four design students, a toothbrush designer, a company engineer and the researcher. The concept was based upon the idea that children can be motivated for tooth brushing through integration of certain graphic sign features in the handle. Three functional concepts were designed, 3D modelled, tested physically as concept models – and two were rejected. After seven physical iterations of the chosen concept including evaluations and discussions, two remained. Each iteration included a large number of drawings and adding clay to iteratively produced RP concept models or existing brushes, as form variations on each basic idea. Each alternative was negotiated between the design actors and tested in the hand. Inter-subjective agreements upon form and function always formed a basis for the next attempt – which was then re-modelled and rapid prototyped anew. Concept models were eventually tested by children in realistic settings. Figure 2 shows some of the iterations and clay-modifications included in these procedures.



Based upon the experiences acquired through participation in all these projects, the analysis of seven in-depth interviews, nine questionnaires, video recordings of four collaborative meetings and one reflective discussion, a list of nineteen sentences extracting the most important shared experiences and observations has been summarised

by the researcher. According to the principles of PAR, these suggestions have been elaborated in plenum debates and discussions between the students, the manufacturers' representatives and the researcher – and frequently changed until inter-subjective agreements were finally reached.

Negotiated observations from the RP-supported concept development projects:

1. Experienced physicality in the form of models has facilitated the communication between the collaborating design actors - as a 'language without words' which has been understood by all participants regardless of background. **2**. Physicality, which could be observed and touched, has given valuable background for establishment of basic understanding of the design problems for everyone involved. **3**. Such basic understanding is behind the verbal discussions we have participated in during the project. **4**. Through shared seeing and touching of physical models, and after that sharing our sensations through spoken language, we gradually develop shared understanding of the design problems. **5**. Such shared understanding of the whole objective of the design problem is a condition for a meaningful contribution from the individual stakeholders who individually may see different aspects of the *problematique* as central issues. **6**. According to the above observations, physicality can be depicted as a 'catalyser' for communication between dissimilar stakeholders of a design team. **7**. Physicality can be produced in many ways (e.g. as mock-ups from cardboard, foam or clay), but as a design concept materialises in a project, RP-produced physicality has proven to be a very efficient design tool for elicitation of catalysation effects between collaborating design actors. **8**. The tool's ability to produce fast, cheap and exact physical models from virtual 3D models makes it ideal for experimentation with different possible (or impossible) design solutions – including many variants of each idea. **9**. Such possibilities open for simultaneous experimentation with many different aspects of design problems such as for instance strength, producibility, material properties, technical functionality, assembly, packaging, ergonomics, aesthetics, market image – in other words parameters of both rational and value-laden nature. **10**. If dissimilar stakeholders shall experiment with different specialities in a design project, then it has been found to be convenient to arrange such experiments as iterations. **11**. In each such iteration all collaborating stakeholders *must* negotiate their own particular speciality – and simultaneously see their own contribution as part of the experienced totality. **12**. The results of negotiated decisions can be seen, touched and experimented with by all actors in each iteration – thereby producing shared meaning and impulses for improvements. **13**. An iterative development pattern also opens for experimentation with radical solutions. **14**. If the focus of a collaborating team is creativity and search for earlier unknown solutions, iteration procedures can easily be directed towards such objectives by being organised as playgrounds for creative experiments with all actors involved. **15**. Many such experiments will naturally lead to experienced breakdowns – and some may produce original results. **16**. The completed cases have revealed that RP-produced physicality involves great 'sense feedback' properties, but it is by no means always the best possible design tool because it can not give immediate fingertip/view feedback to the designer like clay can, for instance. **17**. The modelling of virtual 3D models on a computer screen produces an alienation effect between the designer and the material, which is compensated by the resulting physicality, but this was still considered as a process obstacle because of the undesirable waiting time. **18**. Experiences and reflections in the projects indicate that if material is removed from the concept models through grinding or added manually through use of clay, these drawbacks can be compensated, and 'immediate sense feedback' can be approached. **19**. This observation left us to conclude that there is need for appropriate technology for quick and easy re-modelling of clay adjusted concept models into new 3D models for next stage processing (our technology at that time did not allow this).

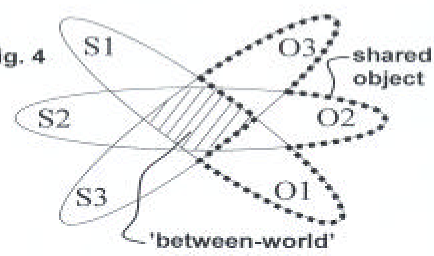
Reflections on the observations

Merleau-Ponty in *Phénoménologie de la perception* [13] builds on Husserl and holds that our prime access to our 'lifeworlds' is created through bodily sense perceptions such as seeing, hearing, touching and smelling – and that our perceptive experiences structure the basis for our ability to "form things through the knowledge which sits in our hands" [10]. He rejects Cartesian dualism of body and mind and suggests a third form of 'existence'- (le corps propre) - situated between the two and in essence 'pre-subjective' and 'pre-objective'. Here the expressed (inner meaning, spirit) cannot be separated from the expression (body, signs, language). But also 'the other's' (the collaborating stakeholder's) existence falls between subject and object. Thereby the world of perception can exceed the individual I who perceives, and the other's perspective can therefore transgress mine. Human social and historical *practice* then forms a 'between-world' (*inter-monde*) between things and minds and between the participating human beings – but all based upon engaged and immediate bodily perceptions before any reflection has taken place [ibid: 334-338].

In Figure 3 such an individual is pictured within an ellipse and in Figure 4, three subjects collaborating towards a shared object from different perspectives are pictured as 'petals' of a flowerlike model. In the center the shared 'between-world' of the actors depicts the stage where 'the battle of interaction' is taking place – where the individual subjects try to come to terms with their own contributions (their objects) to the shared goal, but where *simultaneously* their individual objects must be harmonised in relation to the shared object of which the individual objects are integral parts.

Fig. 3

Fig. 4



To this researcher such a model portrays the negotiated observations. In product development immaterial objects as a rule also have material implications and can be modelled. In our cases the immediate perceptions of physical object suggestions seem to catalyse individual and shared reflective evaluations of emerging possibilities. According to Merleau-Ponty such individual and shared perception can transcend subjects and objects and create a world of immediate understanding (learning). If this is a reality, we can in such a procedure envision an approach to overcome the well-known obstacles of conflicting positions in collaborative design. If such physically based evaluations are arranged as RP-supported iterations, shared learning from the physical experiments can be achieved stepwise in a way where sense-based knowledge from one experiment (as opposed to traditional theoretical assumptions) can be systematically applied to the next. Thereby the development of product concepts could be based upon a strategy of *emergence* rather than of *preconception*. Such a realization can be seen as an elongation of the findings of Ehn, Brandt and Lerdahl, where their basic principles are extended into a landscape of higher concept sophistication and therefore higher potential of learning.

RP-supported fast and cheap physical modelling opens for the possibility of playing with and testing out 'wild' ideas in reality. The argument that creativity belongs primarily in early project phases is countered by the perceived realisation that mind/body experiences of later phases also stimulate imaginative searches for alternatives through alternations between bodily experience and mindful reflection. Radical concepts will frequently generate breakdowns in physically tested reality, which represent valuable sources for creativity because they inspire searches for new ways of tackling the experienced problems [20, 11]. This can be seen as an opportunity to establish an RP-supported strategy as a tool for exploration of creative solutions through provoked breakdowns through staging of arranged *playground* surroundings, supported by well-adapted technological tools.

The observed effects of the alternation pattern between concept models and clay further seems to be of vital importance. Since concept models offer possibilities of manual or tool supported subtraction (e.g. by grinding) or addition of material (for instance clay), I suggest that such procedures should be focused because they favour 'immediate sense feedback' to the designer(s) through view and touch – facilitating the 'ready-to-hand' (Heidegger) or '*le corps propre*' (Merleau-Ponty) experiences. If this result is rapidly copied and adjusted for undesirable surface imperfections, it will offer a valuable point of departure for the following iteration – eliminating computer screen alienation. As our copying technology was a robot arm/software-combination for digitalisation of the physical models, the detailed re-making of 3D models was found to be time-consuming and rough. Based on reflective observations, we sought, found and acquired a fast optical scanner/software-combination from Minolta/Rapidform with appropriate manipulation characteristics. This is presently being tested in student projects which seem to support our assumptions, but results at the time of writing are too premature to be conclusive.

Playing Physical Iteration Games

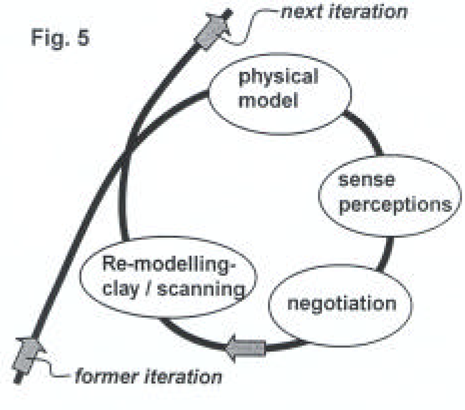
Anti-dualistic approaches to collaborative design have been exposed in Ehn's and Brandt/Gunnet's focused concepts 'design-by-doing', 'ready-to-hand' use, 'hands-on-experience', 'things to think with' and 'things to act with'. Their and my findings illuminate the importance of *physicality* for elicitation of mind/body experiences in design action. It has also been shown that an RP-supported *iteration* approach has a dynamic character. The remaining issue is *play*, for elicitation of creativity, as argued. It is here thus suggested that a procedure involving the necessary elements for collaborative emergence of product concepts can be seen as a *Physical Iteration Game.*

'Physical iteration games' are integrated in the 'language games' of collaborative design. In iterative cycles of physical modelling, sense-based perception of the models, negotiative reflections based on the perceptions and re-modelling based on acquired shared object based knowledge, the collaborating actors *experience* through their objective bodies *and* subjective minds the emergence of their shared physical object – the negotiated artefact (see Figure 5).

In early phases the produced representations should be vague and abstract stimulating imaginationand diversity (see Ehn, Brandt and Lerdahl) but as concepts grow more concrete, RP/scanning-supported 'physical iteration games' can be intensively played more or less 'radically' depending upon individual preconditions or creative ambitions. The games seem to converge different perspectives of rationality and intuition in repeated attempts of mind/body reconciliations of 'word-based' and 'sense-based' languages of the stakeholders.

As the iteratively emerging physical representations produced in this way only eventually will end up as 'prototypes', I will suggest calling them by a more appropriate name: *Negotiotypes*.

Fig. 5



In addition to the described contribution in the conceptualisation and prototyping phases - to what extent can an RP-based communication approach be useful in early and/or late phases of a product development project? I will end this paper by simply referring to our suggested conclusions. Interesting communicative opportunities of RP/Rapid Tooling (RT)-supported modelling of radical concepts were identified a) in the ' Fuzzy Front End' of a design project - where different understandings of *visions* between decision-makers and inventors can be communicated through early physical modelling and b) in the 'Market Feedback' phase - where Rapid Tooling- supported production of test series can lower risk and communicate acceptance or rejection by the future users.

According to Fowler's dictionary a *type* is "a thing serving as illustration, symbol, prophetic similitude, or characteristic specimen of another thing or class" - a definition which applies well to physical models aimed at communication of emerging possibilities. Since physical typing according to our findings has interesting potentials for application in many phases of product design procedures, I have suggested the following concepts:

Visiotyping (Fuzzy Front End), *Negotiotyping* (Conceptualisation), Prototyping as established (Evaluation) and *Seriotyping* (Market Feedback). Seen in a totality these extensions to present product design terminology may serve to illuminate the possibilities opened up by employment of RP/RT technology as a tool for elicitation of design team communication. A concept embracing the whole process could be: *Rapid Multityping.*

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Words and images for exploration and communication of concepts in the early stages of the design task

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ABSTRACT
The problem with the design process when carried out collectively is, on the one hand, the linguistic barriers that make interdisciplinary dialogue difficult, and on the other hand, the diffuse conception of the future artefact on the part of the actors during the early stages of the process. From this perspective, the process of designing is regarded as a transition from a diffuse sphere of concepts towards a sphere of concepts of more concrete character. An abrupt transition from the verbal formulations of those commissioning to the architect's graphic representations may hinder, or be the reason why, the participants are not able to develop their own comprehensible images and visions. One means of eliminating this unsatisfactory state of affairs is to construct a dialogue able to be carried out between the actors involved, before the architect comes into the process. This article deals with the development of a method that uses images or pictures for discussing aspects or phenomena considered to be important for the situation in question. The objective is to provide a richer content for the commission, and a good point of departure for a stimulating dialogue with the architect.

Keywords
Design, participation, dialogue, diffuse concept

INTRODUCTION
In rough terms, the purpose of the dialogue in the early stages of design may be perceived as an attempt at formulating the problem the architect or designer is to solve. The verbal dialogue has its limitations, particularly when discussing something that is ultimately of visual character. One comes to a situation where the discussion is unable to continue unless something concrete happens to revive it. One way of getting out of this deadlock is to allow the architect to come into the process. Based on the discussion initiated, the architect will produce concrete proposals causing the participants to react. The discussion acquires a new breath of life. These concrete proposals are meant to help the participants formulate their problem, thereby providing a fresh basis for the architect's continued production of new proposals, which in turn lead to new discussions. One disadvantage of this approach is the abrupt change over from the verbal to the graphic. The ability of the architect to quickly respond with graphic illustrations may have a hampering effect on the participants' perception of the problem, particularly if they have not had sufficient time for closer reflections about the situation in question. Also, experience shows that even the architect is not free from having fixed ideas. As part of his/her professional experience, the architect has a large repertoire of ready solutions, which may provide a barrier from seeing the specific in the new situation (Birgerstam 2000). It may therefore be important for the client to reflect, and think through what is really needed.

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Common understanding through expansion of concepts
A constructive dialogue during the early stages of a design process should involve participants examining a mutually chosen key concept within in a field, and show for each other in concrete terms what the concept in question is referring to. Such an expansion of concepts does not lead to a consensus of opinion, but to knowledge about other insights. A confrontation of insights may free people from the world of concepts that they are bound up in. It does not need to provide a result that is immediately applicable. The immediate result is the new spectrum of the concept. This is desirable if the new spectrum is to be able to open new associations, and new perspectives. In many instances the group may have to come to an agreement. It is possible that certain insights will dominate, while others will be eliminated. However, in any case those eliminated will remain in the minds of the participants throughout the process, if not longer. They may also be appropriate at a later stage, or receive attention in other contexts during the term of the project. The dialogue should be structured so as to encompass as much as possible of the knowledge potential of the organisation.

The phenomenology of concepts
Concepts referring to the concrete and objective world, and used in the context of the natural sciences, are more clear

cut than those referring to experiences, aesthetic and ethical values, or desired but not existing realities or conditions, and used in the context of the social sciences, politics and ideologies. Ramirez (2000) differentiates between *compact*, *diffuse* and *ideological* concepts. *Compact concepts*, according to Ramirez, are those concerned with things and material reality. They have a well-defined definition covered by words or terms. However, sometimes our words stand for *diffuse concepts*, which can only be made more precise by a concrete situation and our experience. Other words stand for *ideological concepts*. These are concerned with idealised notions i.e. situations that are desired, and situations not existing in reality (and perhaps that never will exist), but may be realistic. The relationship between words and concepts is changeable; the same word may sometimes stand for compact concepts, and at the next moment for more diffuse or even purely ideological concepts.

The design process as a transition from diffuse to compact concepts.

All three types of concepts are applicable in a design activity, in particular if this involves a concrete physical artefact as the end product. In the earlier stages of the process, it is mostly the diffuse and ideological concepts that are in focus. When the artefact begins to take shape, the thought process transgresses from diffuse concepts to more compact ones. The transition from the one type of concept to the other is not sharp, and still less definitive; rather it is iterative i.e. is repeated many times during the process. The role of the architect is to interpret and process the diffuse concepts of the client, and to give them a somewhat concrete, but at the beginning, makeshift form. For this purpose, the architect possesses of one powerful tool, namely the sketch. Architectural activity serves as a bridge between the two conceptual spheres. To hide possible discrepancies between results and expectations - a component of the professional competence of the architect - is also a certain social and rhetoric ability to be able to convince the client and user.

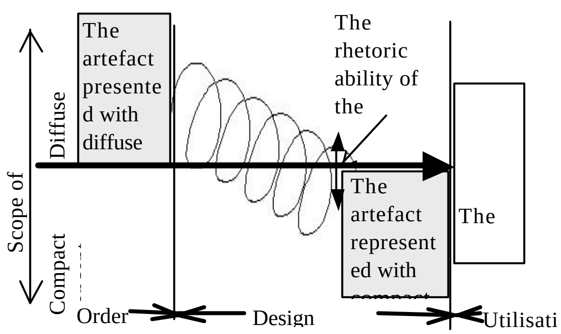

Figure 1. The figure shows the design process as a transition from a commission formulated as diffuse concepts to a form represented with compact concepts.

A dialogue with pictures

The method using images or pictures as advocated in this paper is intended to play its part within the framework of the sphere of diffuse concepts in a common task of work, and long before there is any question of any actual design. The process initiated with the aid of this method in a broader context is also a design process, but not aimed at producing a design as such. It is a conceptual reflection, resulting in an insight among the actors involved about their shared situation, and what is possible to change. With the aid of the picture, the verbal communication is intended to acquire more shade of meaning, and that the actors have the opportunity of reflecting about what they want to say, creating shared insights into common reflections.

Narrative versus imagery

If we compare a purely verbal communication with a purely visual such, we discover an interesting phenomenon that reveals how our comprehension is influenced when we shift from one means of communication to the other. The interesting thing with this phenomenon is if you first relate something, and then show it in pictures for someone, you will get a certain effect. On the other hand, if you show the picture first and then relate you get another effect. In the first case, the person in question forms two notions, or images around the same content. In the second case, the visual experience dominates, and hinders the receiver of the message from forming a personal version from the narrative. This is what happens when we see a film and read the book afterwards. The French architect, Jean Nouvel, uses the effects of this phenomenon to increase creativity at his office. He turns the architects' traditional way of working upside down. Instead of sketching images and showing how he conceives the future design, he uses language, describing verbally for his colleagues at the office how he perceives things.

The concepts communicated in the early stages of processes involving change are diffuse in so much as they are not aimed at concrete and fixed phenomena able to be illustrated in graphic terms. These concepts are aimed at reaching the qualities of the phenomenon. They do not exist in their own right, but together with something having a concrete form. Cooperation, happiness, flexibility do not exist, but cooperating happy and flexible people do. Is it possible, with aid of pictures, to show what cooperation or happiness is? This can be achieved by showing pictures of cooperating or happy people, or also by pictures that enable us to experience happiness. The number of possible images able to be considered suitable for describing a single concept, such as happiness or cooperation is infinite. In this instance, it is *the word that says more than a thousand pictures*. The participants in my experiments chose completely different pictures in order to communicate to others what cooperation means for them. In one case, the concept of cooperation was extended to also include interaction and harmony.

However, does not the picture have a locking effect when showing it takes place before the narrative? Here I claim it is just the reverse; it is the narrative that has a locking effect. In the experiments I conducted, I deliberately allowed the participants to look at the pictures for several minutes before each in turn started to relate what they wanted to say about them. The idea is that the participants are given the opportunity of indulging in the content of the pictures in order to form their own associations, before beginning to say what the pictures are intended to represent. This is done purely for the purpose of avoiding the effect of feeling tied up or locked. When the picture is used to communicate diffuse concepts, it is the association and not the designation that is crucial as regards meaning and importance. A picture arouses a multitude of different associations and feelings for different people. In this case, the picture enriches the communication.

Design activity deals to a large degree with managing pictures and words through the creation and interpretation of meaning. It is a practise that transforms a verbal formulation of a desired situation to a visual representation of an artefact. Differentiating between compact and diffuse concepts has meant that I have been able to regard pictorial and verbal communication from a fresh perspective. It has also shown that the design process can be seen as an activity growing from a situation where a commission is placed, and outlined as a more or less diffuse concept, to an unambiguous and clear-cut representation of a design. In addition, these two types of communication can be utilised in such a way that the process is promoted by the enriching effects at the beginning, and the locking up effects in the final stages.

PRACTICAL METHOD DEVELOPMENT

The development of the method advocated here is based on work of experimental nature. The hypothesis as a point of departure was that the use of images in an associative way would provide enrichment in communication, and make it possible for the actors to better express what is tacit, implicit or difficult to articulate with everyday language. I wrote a scenario for the design process, which I divided into several stages and carried out four experiments to successively test the stages of this scenario. The scenario gradually took form. It finally became a description of the successive stages in the early phase of a collective design process. These stages are: i) to inform the participants; ii) to consult the participants to determine the topics for discussion; iii) to make a synthesis of all the topics discussed, and to choose some of these for the participants to illustrate with images; iv) to bring together the participants for an initial collective reflection (during this stage each participant would present images followed by comments to the other participants); v) to get the participants to choose images representing the collective impressions of the group; vi) to bring the participants together for a second collective reflection in which they would present the images illustrating their collective impressions to another group or professional e.g. an architect, outside from the group**.**

I carried out four experiments to test the scenario. The experiments succeeded each other from the simplest one, with only one person, to the most complex one gathering two groups of actors. The goal was to successively explore the complexity of the process. In the first experiment involving only one person, I could concentrate myself on the practical problems, such as the difficulty in finding images, if a large number of images is problematic, how to inform the actors, how to choose topics raising interesting aspects to discuss etc. The images used in the experiments are from a commercial photo stock directory presented in ten catalogues with a total of ten thousand images.

The last experiment was the most complete. It was based on a real project. The university planned to build a multimedia centre connected to the library. Three architectural students took the opportunity of working with this, since architectural training is invariably based on concrete projects. This project was specific in character, since the artefact in question is rather uncommon. What is multimedia? To find out I set up the experiment in which the students acted the part of the future users of the multimedia centre. The library staff were also interested in taking part in the experiment. They also hade no clear idea of what the multimedia centre could be. The staff at the library comprised of three persons, the manager, chief librarian (both of whom with physicist backgrounds) and a system administrator. The concepts that has been discussed in this experiment where, *multimedia*, *communication*, *learning centre*,

What I have learnt from these experiments.

The experiments gave rise to an interesting observation. During the choice of images procedure, I observed the actors performed in an unexpected manner when choosing their images. They examined the images, made a preliminary choice, compared the images, and replaced certain images by new ones. The actors appeared to have a dialogue among themselves, as if they were thinking aloud. I observed this procedure every time I had occasion to witness their choice of pictures. I also felt that the participants, when browsing among the catalogues, were looking for something but did not know exactly what until they found a particular image.

At the beginning of the development of the method, I made the distinction between two types of communication. I distinguished, on the one hand, the interdisciplinary communication within the company restricted by linguistic barriers i.e. a problem of language game, and on the other hand, the communication between the architect and the actors of the company restricted by the asymmetry of the means of communication i.e. words versus the architect's drawings and sketches. The experiments were based on these two types of communication. It was first afterwards I became aware of a third process of communication at the individual level. It became clear to me that this complex process of communication consists of three types of dialogue, an 'inner dialogue', an 'inter-subjective dialogue' and an 'inter-personal dialogue'.

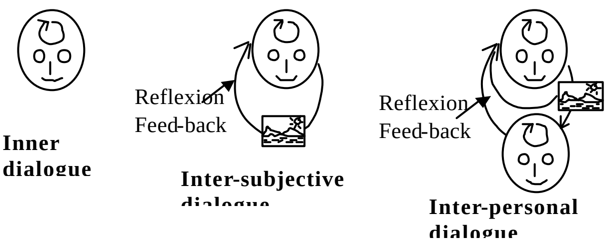

Figure 2. A simplified illustration of the three dialogues.

Some results of the experiments. [1]

The experiments have shown that communication is not only a transfer of information between individuals. The choice of images i.e. browsing in picture catalogues, is also in a certain manner a communication process in itself. The actors often do not seem to know exactly what they want to express at the beginning of the process. Even if they do know, they will probably modify their initial ideas after the first reflection, or even abandon them altogether. The images were used as a stimulus for the actors' thoughts. The images helped the actors to think and develop ideas in a more complex way than would have been possible solely with verbal language. One person said: "*I see new things in my picture each time I'm asked to describe them*". In one of the experiments, I noticed the visionary aspects were much more accentuated in the images presented by the actors, whereas the problematic aspects were expressed verbally. The actors had expressed many more aspects than they were asked to do. They also found other topics because of the images, and in this manner were able to explore and express a wider aspect of the concept in question than they would have done solely with the spoken language.

The last and the most complete experiment conducted with students and library staff showed that the concept of *multimedia* represents different things for these two groups. For the staff of the library, the multimedia concept is firmly associated with the data processing and the computer. Most pictures chosen by the staff show computers or pictures of phenomena simulated by the computer, or pictures processed by a computer.

Some of the images selected by the library staff to illustrate the concept of "multimedia"

The student architects, on the other hand, do not have any picture associated with data processing. Their pictures mostly illustrate human activities, such as work, games, leisure and human contact. Some of their pictures show a group of people playing music, or conversing, working or doing some thing. One picture shows an adult's hand caressing a baby's foot, and another picture shows an adult playing with a child.

Some of the images chosen by the student architects to illustrate the concept of "multimedia"

During the interdisciplinary dialogue, the two groups, while confronting their respective pictures, became aware of what the 'multimedia' concept really represents for each group. This experience confirms that the concept of multimedia is a diffuse one. For the staff of the library, with physicist backgrounds, the computer and data processing provides the opportunity for the physicist to visualise physical

[1] The experiments has been described in detail in my licentiate thesis (Rehal, 1997).

phenomena that up to now can only be represented by a mathematical language. For the student architects, on the other hand, visualisation is an obvious part of their profession, as they work with images all the time. From their point of view, 'multimedia' seems to stand for human communication in its various forms. The images together with the discussion narrowed the gap between the views of the participants. The library manager said at the end of the experiment, "*we're talking the same language… of course multimedia isn't only computers… we have to take advantage of new technology without losing the human contacts, all our images show that*". I heard an architectural student say after the experiment, "*It's incredible… just write a formula on the keyboard, and you can see it on the screen*."

Another concept discussed with the means of pictures was the "*learning centre*". This concept was related to the character of the future multimedia centre and was chosen to be discussed by the library staff only. By comparing and discussing the images, the participants from both groups distinguished two concepts that could be associated with the pictures; *learning* and *teaching*. Terms such as '*one way communication, centralised teaching, cross communication, activities that cross each other, chaos, self learning,* have been used by the participants of both groups during the brainstorming sessions.

Images chosen by one participant from the library staff illustrating a chaotic learning situation in contrast with one illustrating a disciplined situation.

The images come from the library staff illustrating a traditional learning situation and a computer aided learning situation (self learning).

Finally, the participants came to a common agreement; the multimedia centre will not be some kind of library, nor a laboratory, but a place where all kinds of activities can meet. The concept of '*positive chaos*' was used for describing the character of this place, and one image was chosen collectively to illustrate this. The image chosen is the one above, which illustrate the chaotic learning situation. This concept may seem very diffuse for the reader, who has not participated in the brainstorming, but not for the participants who created it. For them the concept of *positive chaos* was the fruit of a long discussion where both groups explored and expanded the field of the concept learning centre.

CONCLUSION

The image as means of communication for exploring and communicating concepts is relevant in the early stages of the process. This is especially because it is less conventional than the spoken language, and it forces people to reflect on what they are saying, and to sharpen their attention with regard to what the others really mean. The spoken language is used in an unreflective manner; people interpret or understand the content of a concept automatically through their own way of seeing things, and without thinking about it. The experiments have shown that images stimulate reflection at the individual level. They also show that images in combination with words are a powerful instrument for bridging the interdisciplinary dialogue, but also for exploring and enriching the field of the diffuse concepts concealed behind the verbal formulations of the commission.

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“In MY situation, I would dislike THAAAT!”

Role Play as Assessment Method for Tools Supporting Participatory Planning

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ABSTRACT
The transitory nature of some participatory planning settings means that traditional PD methods are not feasible during early stages of technology development. Role-play represents a promising technique for addressing this situation. We present our experiences in using role play as a participatory assessment method on two variants of a system for participatory planning. We summarize system-related assessment results and discuss limitations and potential improvements of this method.

Keywords
role play, assessment methods, PD, system design, urban planning, group support, graspable interfaces

INTRODUCTION
Tapping into the perspectives of those most affected by a new artifact or system is predicated on having users and a practice that are accessible. However, creating support for participatory design groups whose very nature is transitory represents a challenge for system designers. Such groups are virtually inseparable from the context of the specific problem they have convened to resolve. They have their own timelines and often focus on short-term goals, not on helping the research process or future groups by participating in the development of support tools. The nature of research software development has an impact on this process as well. Research prototypes are not generally ready for real situations because they “lag behind” in terms of capabilities, depth, usability, and stability–and they risk getting in the way of real tasks.

This does not mean that we cannot draw on the insights of participants. Initial knowledge about the domain and typical problem issues is needed to develop a reasonable prototype. As examples, we have profited from the observation of previous activities in participatory neighborhood development [1] and cooperation with urban-planning professionals.

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USING ROLE PLAY AS AN ASSESSMENT METHOD
To assess two different prototypes of a system supporting citizen participation in urban planning, we decided to develop and use a role-play scenario. By recruiting subjects to play roles in a problem-solving situation using our support technology, we intended to test the systems under close-to-life conditions, to gather concrete ideas for further development, to collect user feedback and to evaluate the usefulness of user interface concepts (e.g., tangible/graspable interfaces, augmented environments).

The decision to use role play was motivated by the following considerations. Real situations will be ill structured and result in conflict. We wanted something that brings out these aspects along with emotions, context, and perspectives. Contextualization is important to make participants behave ***as if*** the problems were real and relevant, to avoid abstract, rational-problem-solving behavior. Because usability in group interaction is likely to differ from single-user usability, we wanted to start right away with group situations, identifying salient features and generating ideas. Role play based on concrete scenarios seemed a promising method to meet these concerns.

The Use of Role Play in PD
Dramatization is a form of experiential learning, that provides concrete and immediate feedback, while remaining in a safe environment [6]. Whereas standard role play consists of an initial scenario and given roles that can be freely enacted, other types of role play may have prescribed structure representing models of possible real situations with a “game-master” introducing events and guiding the manner in which the game unfolds. Role play needs some trust and ease of interaction in the group. It has been used in PD, often as part of Future Workshops, in the form of organizational games [7], as a participatory invention/envisioning method for future technology [9], or

as dramatic vignettes to stimulate discussions in focus groups [10].

In comparison to other uses of role play, we prescribed a scenario with given goals and used a working prototype instead of mock-ups. Our primary goal was to gain insights into usability and applicability of the technologies, making our approach close to user-centered design approaches. The role players' experience was essential for the discussion following the session, providing participants with deeper insights because they have experienced the technology first-hand in an engaging and goal-oriented situation.

THE SYSTEM STUDIED: THE EDC

The *Envisionment and Discovery Collaboratory (EDC)* is a prototype of an integrated environment for supporting heterogenous design groups and community participation. Building upon physical, game-like methods in participatory neighborhood development, the system is inspired by the game board of physical design games, but augments the tactile, physical game pieces with the dynamic capabilities of computational simulation (see [2]). The EDC can be classified as an augmented environment and, because of its focus on tactile, physical game interaction, as a tangible (or graspable) user interface (see [3,11]).

Individuals using the EDC convene around a computationally enhanced table where constructive design activities take place. Participants create and manipulate the computational simulation projected onto the surface by interacting with physical objects placed on the table. Our assessment study focused on two different implementations. One uses a horizontally mounted, touch-sensitive SmartBoard™ electronic whiteboard (Figure 1). The other uses the Participate-in-the-Action Board (PitA-Board—see Figure 2).

Figure 1: EDC-SmartBoard Version

Figure 2: Interaction with the PitA-Board

The SmartBoard provides an interface similar in large part to a high-resolution touch screen with a single cursor along with sketching pens and a sketching mechanism. However, the touch-sensitive surface does not support true parallel interaction. The PitA-Board [4] was developed by the EDC team at L^{3}D as an alternative interface to overcome these limitations. The underlying technology consists of an 8-by-8 grid of 2-inch squares that can sense the location and identity of 15 distinct transducers. These transducers can then be imbedded in physical objects, allowing for multiple cursors and simultaneous interaction. The PitA-Board ability to track tokens complies with the definition of graspable interfaces [11]. In the assessed version, two grids were assembled in tandem to form a larger board.

APPLICATION OF ROLE PLAY TO THE EDC

To understand many of the issues faced in the design of the systems, our assessment was targeted on insights at several levels: usefulness, usability, interaction design, group interaction, and applicability to realistic tasks and group interaction. We decided against locating a specific neighborhood group and an actual problem and elected to engage subjects in role-play. The research team adapted a transportation scenario previously used in our research and fleshed it out with details appropriate to the capabilities of the two systems. A set of roles was developed for the participants.

Subject Selection

We recruited two sets of subjects (one for each system). We succeeded in finding participants who were not well versed in the computing, public-transportation, or urban-planning domains, including people from outside the university. The SmartBoard group, two men and three women, was well distributed in age (from early 20s to late 40s), and represented diverse life experiences, including a mother of teens. The PitA-Board group consisted of: two female and one male undergraduate students and one 50-year-old local single mother.

We held two sessions during the first week of November 2001, staged as neighborhood meetings, with the research team playing the roles of technical and process facilitators. At the end of the sessions, we engaged the groups in discussions aimed at gathering their impressions, responses, and suggestions. Each session (including the follow-up discussion) was videotaped for later analysis with the consent of subjects. The researchers shared initial impressions and watched the videos individually and together during subsequent days.

Scenario

The scenario was the following: Transportation planners have decided to redesign an under-used bus route through a local neighborhood to better serve the needs of the residents. The bus route may be expanded or re-routed. Planners determined about 5 minutes slack in the bus schedule and identified appropriate streets. Interested neighbors are called together to propose an improved route and bus stop locations.

Subjects convened around the boards, which showed a map of Gunbarrel, an outlying neighborhood in Boulder, with major streets highlighted. The subjects were allowed to choose from role cards describing personae that spanned population groups with different needs such as: a college student, a young working mom, a couple in their fifties with teenage children, and 75-year-old grandparents. The session was patterned into different phases.

Phase 0 introduced participants to the system and gave them a chance to get familiar with the task, the map, the system, and the interaction methods.
Phase 1 allowed participants to place their house tokens onto the map and fill out surveys about their personae while introducing themselves to each other.
Phase 2 was a deliberately open-ended discussion, giving group process a chance to evolve. All facilities could be used. Both groups started to discuss options.
Phase 3 asked how far participants would be willing to walk to a bust stop under ideal conditions. The chosen distance was immediately displayed as a translucent colored circle around houses. The intersection of circles was highlighted.
Phase 4 asked about less ideal conditions that might change the preferred walking distance.
Phase 5 consisted of the final discussion about the bus route and placement of bus stops (maximum 8 stops).

OBSERVATIONS, PROBLEMS AND EXPERIENCE

Our observations were exploratory and open to emerging themes from repeated video viewing. The results span multiple issues, including underlying technology; physical, interaction, and task design; facilitation; and role-play.

Group interaction and session length differed greatly. The SmartBoard group interacted successfully with the system, cooperating intensely while arguing opposing opinions, even though they experienced several technical breakdowns. The group using the PitA-Board, however, did not get into role-play; their interaction was slow and full of pauses. Nevertheless the assessment sessions provided us with a wealth of observations and lessons to learn. For example, we found that in the PitA-Board variant, the reduced size of the game board, the small number of interaction objects, and the missing sketching facility did not invite enough interaction or foster a creative and exploratory mode of problem solving.

Sketching had been a very important feature of the SmartBoard version. Redoing sketches helped participants build a shared understanding, visible in fluent interaction and shared drawing. Missing, however, was the ability to save and recover sketches. In contrast, the PitA-Board group could not sketch, and relied on talk, gestures, and the map. Drawing the final bus route demonstrated a weakly shared mental image, with long pauses in-between. All participants liked the visualization of walking distances. They said, in the subsequent discussion: “that was a nice little feature, you see the hot spots.” Other simulation facilities (e.g., animation of a bus) did not offer much support. Nevertheless, we were inspired with ideas on additional features, for example, answering some recurrent “what if” questions such as: How much time does the new bus route take? How much time does each bus stop add?

The SmartBoard induced cooperation simply due to its size, because participants needed to help each other in order to complete tasks. On the smaller PitA-Board, everything was within easy reach. In addition, the projection extended a bit over the edges of the board. This appeared to inhibit people from intruding into this space. While the SmartBoard was *inside* people’s personal space, touching the PitA-Board became a more explicit action.

The assessment indicated that the inability of the Smartboard to handle parallel manipulations produced serious disruptions. But parallel action by itself does not guarantee cooperation. Indeed, system characteristics (e.g., size, distribution of resources) that compel people to help each other or to coordinate actions may contribute to the evolution of group awareness and feeling. The sessions provided us with intricate insights concerning interaction design for graspable tokens. We had to realize that these tokens were superfluous and tedious in the case of the SmartBoard. Yet the sensor-equipped graspable tokens of the PitA-Board made interaction very intuitive and enjoyable. We developed many ideas for how to improve interaction design, in order to heighten the amount of interaction with tokens, to improve their representational value, and to better exploit their graspability (for details: [5,8]). Our observations inspired us with many ideas, which have in part already been realized. Results confirmed our decision to search for alternative basic technology, but also taught us that it is the details that make the difference.

Results in Terms of Methodic Issues

Facilitation and Task Design

In our design of the session, we decided to act as technical facilitators, as needed, to make participants aware of system features. However, this approach might have several effects: intervention of a facilitator could disrupt ongoing conversation, using more system features might slow-down the process, or the process might get driven by what the system supports rather than the task at hand. Indeed, some differences in observed group behavior can be traced to facilitation. When the SmartBoard facilitator demonstrated filling in the survey, he said: “I am XXX and own a car.” Most people in this group imitated this. The other facilitator did not talk much and emphasized being able to work in parallel. People in that group immediately did as told, acting in parallel and not talking. During phase 0, we missed opportunities to make participants experiment with the technology. The facilitator showed how to use several tokens, but only once encouraged the participants to try them out. More actions could have been explicitly delegated to participants instead of demonstrating them. Our lesson from this is that we must think in greater detail about our facilitation approach and opportunities for involving people early. One way to do this is to simulate the session within our design team, tape it, reflect on it, and collect ideas about alternative actions. This would train facilitator behavior and sensibility, plus making facilitator behavior across sessions more consistent.

Our goal had been to create a task that would be difficult and ill-structured enough to generate some conflict. Yet we needed a manageable, narrow slice of such a task. Earlier cooperation with the transportation department gave us an idea of such typical decision situations and influencing factors. However, both sessions experienced few conflicts or trade-offs, and a general idea was developed quickly. This idea was only slightly different in each case because only a few minor variations were possible based on the map given. For further studies, we need scenarios that offer more alternatives, trade-offs, and conflict.

Role Play

The SmartBoard group became very involved during the session. They quickly started appropriating roles in lively ways: "Well, being a single mom [points at her house] and getting my kid to the bus stop is not THAAAT easy" or from another person who objected to a proposal: "In MY situation, I would dislike THAAAT [points at her house]. I would need to go into the bus, go up AAALLL the way up here [points along road]." This group invested a lot of effort to evaluating consequences and exploring alternatives. This is very different from the other group which rarely talked in the voice of the persona they had chosen to play and did not become engaged. Some remarks indicate that they interpreted the situation as requiring rational problem solving. For example, they asked at the end: "Are there any more phases?" and often: "Are we allowed to XXX?", which we interpret as a desire to find *correct* solutions. But even as rational problem solving, the design process lacked depth. There was little weighing of advantages and disadvantages, and final bus route drawing revealed uncertainty whether the solution idea was shared. Participants seemed to be evaluating ideas silently; ideas were not publicly criticized and scrutinized.

The age of the participants may have contributed to this behavior. The ability to role play effectively (beyond fantasy role play) may be linked to maturity because it requires the ability to take perspectives and shift between different roles and personae. Since most participants in the PitA-Board group were young, they may have been unfamiliar with role play and lacked life experience for the roles of older personae. In addition, undergraduates are accustomed to school-like situations that require producing "the right answer." As a result, and furthered by the videotaping of the session, they might have felt observed and evaluated. In fact, it was often the only older person in this group who broke the silence.

The literature on role play has often noted, that role play can make participants feel uncomfortable, because it may trigger previous, unpleasant experiences [6]; it needs an intital amount of trust; and it may be unfamiliar as a method. This points to the need to invest more energy into making participants feel comfortable. It also seems reasonable to avoid using undergraduates as subjects.

Role of Subsequent Group Discussion

After the role-play session we initiated a discussion. For some aspects, especially the role of graspable tokens, we had to ask explicitly, but managed to initiate lively discussion. We also asked for feedback on some ideas for improvement. Participants suggested improvements as well. Most of the major insights we gained from the videos had already been hinted at in these discussions. Whereas subjects' impressions and ideas were very important and in fact focused our subsequent video analysis, this feedback was not taken as a definitive indication that particular features should be added or modified. Rather, both feedback and observations were used to plan the next design steps, which might take the form of new features or experiments aimed at testing hypotheses to clarify design choices.

Not taking participants feedback as definitive evidence may at first sight contradict our intention of participatory design. But subjects' impressions reflected their specific experience, including design flaws, the particular group process, and individual backgrounds. Subjects judged our ideas based on this experience and could only partially imagine how a different system design might have changed the process and interaction experience. In particular, participants seemed to refer to prior experience of WIMP interfaces and GUIs, which implies interaction concepts that we deliberately want to avoid.

LIMITATIONS, LESSONS, AND FUTURE OPPORTUNITIES

Although differences between the groups do not allow strict comparison of group interaction across different media, the assessment sessions and discussions provided us with a wealth of observations and lessons learned. The use of role play, although still a considerable distance from the desired user communities, provided us with insights that allow our systems to improve. Some of these insights can be translated into system improvements right away, other issues ask for detailed, systematic evaluation. The study shows that role play is a fruitful method for early stages of system development.

Improvements to the Method

We feel that role play can play a valuable part in a larger participatory design process. This can consist of a range of assessment types, which address issues of different scope: (a) Some issues can be assessed with standard usability tests in isolation. (b) Testing in 'local' (lab) groups is appropriate to train and improve facilitation, and to test the role play scenario and parts of interaction design. (c) The next step, role play with external subjects, has been described here. (d) Another intermediate step may be useful before proceeding to completely authentic settings: to involve authentic groups (e.g., actual people from a neighborhood), while still using carefully chosen model tasks. (e) Finally, application should be extended to authentic groups and situations.

Issues of appropriate technology and design of individual interaction with representations can be addressed at the earlier stages. Group interaction with physical and virtual models, facilitation, and the role-play scenario should be tested within the local (lab) group. As we progress towards authentic situations, it becomes more important to support and model social interaction, realistic scenarios, (model) tasks and problem domain and finally the authentic tasks and problems. No specific order for applying these assessments will be the most productive in all situations.

Our facilitation skills and group process might have been improved by simulating the session within our design team first. However, given the limited time available, it was better to make progress than to spend more time perfecting the process. It may be advantageous to assess a system at an intermediate level. Thereafter, the design process can focus on the most relevant interaction aspects (in isolation) and identify specific issues for subsequent studies. Had we studied single-user interaction, neither the issues of sharing space, nor the effects of cooperative drawing, nor the importance of sketching for building shared understanding would have surfaced. In single-user situations, the size of the SmartBoard might have been seen as a problem, rather than as a potential advantage. Which simulation features might be useful become salient only after experiencing concrete group processes and specific needs. Some aspects of interaction, such as changing and drawing bus routes, can be tested in isolation. Whereas such issues might be visible in isolation, other facets will turn up only when evaluating role play sessions, thus demanding iteration.

CONCLUSION

Whereas an ideal design situation would work with participants, the challenges for involving transitory groups make this difficult. Therefore, we need to find ways to approximate this input to the design process. We found that role play provided a great deal of such useful feedback. These insights were better than an ad hoc approach or a standard usability approach focusing on low-level, isolated interaction techniques. By creating a context, our insights allow us to develop more appropriate interactions, which can then be tested and improved as needed. This allows us to focus on specific issues in future studies (see [5]).

We do not see that role playing is the end of the process. With continued work on interaction, facilitation, simulation, and other support, we plan to move to authentic participants engaged in model tasks and situations and refine our system to the point that it can be applied in truly authentic settings.

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Improving Infrastructures by Transforming Narratives

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ABSTRACT

In this contribution we are introducing the method of Narrative Transformation by first outlining the contexts for which Narrative Transformation is useful, then describing how to proceed and, finally, reporting from practical experiences with Narrative Transformation.

INTRODUCTION - IMPROVING INFRASTRUCTURES, PURSUING INTERESTS

In this contribution we are introducing the method of Narrative Transformation. It is a method supporting informal groups interested in further developing their infrastructures in a direction that is beneficial for them. We are first outlining the contexts for which Narrative Transformation is useful. Then we are describing how to proceed. Finally, we are reporting from practical experiences with Narrative Transformation.

When computer applications are developed the »circumstances around« - such as power structures, interests and purposes - become objectified in them. If the computer applications become employed, individuals locally and subjectively appropriate them. Possibly, a spectrum of their potentials is discovered. If this is the case, these discovered possibilities bring about real practice with the computer applications. According to the location, situation, constellation, etc., computer applications are adapted and transformed into a currently appropriate means, hence further developed. (Accounts and theories of these processes are to be found in references as diverse as Leontyev, e.g. [7, 8], Latour and co-workers, e.g. [1], Suchman, e.g. [10], Hofmann e.g. [5] and many others.)

An artifact - here: a computer application - usually is only one part of a larger whole. This larger whole has historically evolved and has been shaped by actively intervening subjects. The boundaries between creating computer applications and designing one's everyday (working) conditions by means of these computer applications are blurred: in the course of designing conditions by utilizing computer applications these applications are further developed. An artifact also usually belongs to a conglomerate of artifacts, resources, practices, etc. that seems relatively self-contained from certain perspectives: an infrastructure.[1] Artifacts of an infrastructure are related to each other through references between their meanings and through practices. Integrating artifacts into already existing infrastructures requires specific practices. Such an integration is by no means immediately and arbitrarily feasible. A new computer application, for example, even when it is »technically« functioning, is not employable out of itself. Its employability in a specific context is closely related with the historically grown infrastructures of this context, including their references and practices. Locally accepted and viable infrastructures interact with infrastructures which are experienced as globally accepted and valid. This has to be regarded when trying to understand infrastructures in their specific meanings. Tracing their current references and reconstructing their historical trajectories helps appreciate their specific potentials.

The question we are addressing in this contribution is: How can we contribute meaningfully to the creation of an infrastructure that is really beneficial for us? Before introducing the method of Narrative Transformation which we invented as a means to meaningfully contribute to the creation of infrastructures we first have to explore the "we" whose desire is to contribute.

Whether or not »standard interests« in »standard constellations« have ever existed - the standard ways of representing interests seem to have become obsolete in many settings, for example union representation in New Economy organizations (cf. [12]). Identifying one's interests, articulating them and pursuing them have become success factors, not only in the New Economy. The importance is indicated through the huge market for coaching, supervision, negotiation training, mediation and the like. In many societal fields - such as education, research, social work, information technology, gender relations - people

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[1] For the term "infrastructure" cf. [11]; for infrastructures as encountered from individual perspectives, situations and positions cf. [6], p. 359ff.

gather in specific groups for maintaining and improving their working capacity. These groups have to be composed of the right people. Work related issues in need of clarification are discussed and appropriate approaches are collectively elaborated. Participants try their viability and beneficiality at work and possibly discuss the results of these attempts in the group, they collectively further develop their approaches, and so forth. On the one hand, these groups are highly relevant for their participants' work lives. On the other hand, they are formed beyond their members' work lives and in a sense are »orthogonal« to their everyday lives. The groups are based on a common objective, interests that are perceived as shared, complementary or converging (even though specific interests are collectively to be reconstructed), trust, the absence of perceived hierarchy of dependence, and rules and assurances (e.g. regarding the secrecy of the discussed issues). These groups hence are protected spaces for experimentation much more than the work settings of the participants. Especially the hypothetical pursuit of interests and steps toward improving the members' work lives are possible. *Narrative Transformation* provides a framework for *proceeding* in this kind of group when the objective is the *improvement* of their members' *work infrastructures*.

NARRATIVE TRANSFORMATION - THE METHOD

Narrative Transformation is rooted in the participatory action research programme of Critical Psychology (cf. e.g. [6], chapter 9) and its episode-based variation of Memory Work (cf. e.g. [3]). Like many participatory design action research approaches, Narrative Transformation is a framework in which research and change - here: the (re-) design of infrastructures - build a unit and in which the participants themselves are the researchers and change agents. In this section we are depicting and explaining the activities comprised in Narrative Transformation.

First, the Narrative Transformation *group has to be established*. Then, the *common objective* within the field of infrastructure improvement has to be *formulated* in a first version, e.g. improve groupware use; design a new computer application. During the Narrative Transformation process, it very likely becomes necessary to revise and newly formulate the collective infrastructure improvement objective. During the entire Narrative Transformation process the participants *acknowledge already existing results* relevant for their objective, e.g. from research, development, discussions, etc. and compare them with their own preliminary results. At some point the common objective is so clear and focused that all participants can remember pertinent encounters. They all individually write them down. For *writing* these *episodes*, practitioners of Memory Work (e.g. [4], p. 135ff) recommend to (1) write episodes with a defined beginning and end, (2) write in the third and not in the first person ("When she once...") and (3) restrict the length of the episode to one page.

The *collective analysis of the episodes* comprises the *analysis of the individual episodes* and *comparisons*. For the analyses, *dimensions* are at first *generated and assembled*. For this first set of dimensions the Memory Work literature (e.g. [4], p. 135ff; [2], p. 147) contains recommended dimensions such as plot of the episode, self-construction of the author, constructions of other actors and relationships, contradictions, clichés and remarkable expressions, emotions and implicit theories. On a sentence-to-sentence basis the group examines whether the episode contains content regarding each dimension. The content and comments are written down. Wall charts are suited here for visualization purposes and can be used instead of taking minutes. According to the episode, objective, group, interest, focus, etc., further dimensions are introduced for the analysis. In Narrative Transformation infrastructure related dimensions are vital. In the course of the single episode analyses and comparisons, further dimensions might be added while others might be dropped. The dimensions of the analysis should be an objective of collective reflection in its own right. Categories are essential for analysis and design, yet they often do not become explicated, either because they are not conscious or because they seem to be too obvious and self-evident to be articulated. Conscious analysis always comprises explicating or generating the very dimensions of the analysis. In this way participants get to know each others' guiding categories including their political dimension [9]. The categories are then amenable to change if they prove to be dysfunctional. The *comparisons* may follow the dimensions generated and used so far; new dimensions might again be introduced. The results of contrasts can be manifold: sameness, complementarity or contradiction might become apparent.

Analyzing the episodes ideally provides clues for the *constructive activities* that are to follow. As soon as the participants have an understanding of situations worth improving, new modes of shaping them and acting in them are to be invented and collected. Especially new artifacts and (constituents of) infrastructures are to be conceptualized and realized. One of the many possible approaches here is to write new episodes, e.g. describing viable modes of dealing with problematic situations. These follow-up episodes do not necessarily have to be based on recollected encounters but may also be fantasized scenarios. They might for example contain hypothetical solutions for problem situations in the original episodes or they might especially underline the potentials of certain successful practices described in the original episodes. Further constructive activities such as the *experimental* *creation of artifacts*, e.g. mock-ups or prototypes, might be pursued during, as part of or after analyzing episodes. *Trying out* the newly created or harnessed possibilities in the group and at work is an essential part of Narrative Transformation. The gained *experiences are fed back* into the group. Building on the gained results depending on the needs of the group members, Narrative Transformation activities may be resumed.

Practitioners of Narrative Transformation are encouraged to *adopt and integrate other suitable approaches*. The approaches and activities to be integrated into the Narrative Transformation process might originate from the most diverse fields of theory and practice, of research and development, such as Participatory Action Research; Participatory Design, e.g. the Future Workshop, Organizational Games, Simulations, use of mock-ups, prototyping, drama techniques, video-based techniques, work with metaphors and use of photographs; participatory planning; Requirements Engineering; design and modeling of computer artifacts; Software Engineering; creative problem solving; mediation; group dynamics; supervision; and methods from the social sciences, e.g. discourse analysis, contrastations of texts (such as an episode as contrasted with a speech by the president of the author's company toward the shareholders).

All methods under the umbrella of Narrative Transformation should be employed *within the group* and not as research/design procedures about/for other people.

NARRATIVE TRANSFORMATION - AN EXAMPLE

The *group of participants* for this example comprises four persons who are involved in CSCW and PD research: a PhD student who commutes between Britain and Germany and two research assistants and a research scientist who work at a large institute for applied information technology. (The authors are among the participants.) The students and the research scientist are part of a larger research group and collaborate closely. The group belongs to a larger informal alliance of young researchers and friends interested in research. They discuss work-related issues, for example in a bi-weekly reading group; in communications about their theses, research papers, and research ideas and plans; and in informal discussions about their lives as (becoming) researchers, everyday activities related to research, procedures, grant writing, job perspectives, technical support, etc. These discussions take place in face-to-face meetings, on the telephone, in telephone conferences, via email and by using the BSCW shared workspace system (see http://bscw.gmd.de/).

The *four episodes* with which the Narrative Transformation process began and which are to be discussed here were written in summer, 2001. The aim of the process is twofold: (1) The participants wanted to try the procedure and find out whether it was useful and how it might be improved or modified for future use. (2) They want to use the procedure for understanding and improving their work infrastructures. The four episodes were analyzed, and, as part of the Narrative Transformation work process, new episodes were written. The topic on which the participants had agreed was "An event in my everyday research work". The summaries of the episodes are:

Episode 1 (E1) "Mister Anywhere": The author packs for a business trip to visit his dissertation supervisors abroad, uses his checklists and does chores and errands. He ponders upon many things related to the trip, looks for things and tries not to forget anything that might be important. While doing this, he thinks in associations.

Episode 2 (E2) "Logo? Logo!": The author receives an email in which project partners from another research group express their confusion that nobody in his research group contributed to the logo contest they had agreed to perform. He asks himself how this could have happened, even though the planned procedure made so much sense, was easily feasible and was appropriately supported by technology. He blames himself and eventually returns to his agenda for the day.

Episode 3 (E3) "A day in my research group": Back from school today the author turns to his work for the research group. He finds out what he has to do today and then does it. He does not work in the office because he lives in another city. In order to find out the next tasks from home he first looks in the BSCW workspace and then calls his colleague. They have intense discussions in which he learns a lot. Afterwards, he quickly takes a few notes. Before turning to other activities in other areas of his life, he notices a prompt feedback email from another colleague. That feels good.

Episode 4 (E4) "All for all? All for one?": In the research group they had previously agreed to discuss on a weekly basis their theses, research papers and work on discoursive design. An important paper the author wrote in preparation for her dissertation could not be discussed in the research group for a long time and for various reasons. At last, the author discusses her text with three colleagues in two-by-two meetings and gets valuable feedback.

From the Memory Work literature mentioned above we agreed to use the *standard analysis dimensions*. Before the analysis we already agreed to *add* the dimensions of (1) questions, e.g. regarding the context of the episode, and first collective answers and (2) production and use of technology. In the course of the analysis of the individual episodes we *additionally introduced* and used the dimensions of (3) utilization and further development of work relevant resources, including explications on what the resource is for, what it renders possible (or is supposed to render possible) and in which relations it is situated; (4) aspects of the situation in need of improvement, respects in which they were in need of improvement, plus collective ideas for the improvement of the situation; and (5) good practices, situations they referred to, respects in which they were good and what they achieved. While the participants used the dimension "production and use of technology" they realized that this dimension was definitely not sufficient for capturing the important issues related to their infrastructures, for example in their evolution, wealth of meanings and references, connectedness and enabling character for specific practices and results. Yet, they hesitated to just include a category "infrastructures". It seemed so much more to the point to explicate resources at work, what these resources served for, what they enabled and in which relations they were situated. The participants discovered their implicit hypothesis that infrastructures have the character of enabling resources and that infrastructures should be framed, considered and captured from the perspectives of individuals, from their positions and in their situations as suggested by Holzkamp ([6], p. 359ff).

We are arranging the topics and preliminary results that crystallized in the analysis of these four episodes into the rubrics of *division of work and cooperative structure*, *work routines*, *personal accountability and self-organization*, *sustainable work practices* and *making sense of infrastructures, inhabiting common information spaces*.

The *division of work and the structure of cooperation* in the participants' contexts is a big topic in the episodes, for example: (1) Research group meetings do not take place as agreed. The author of E4 hence initiates feedback meetings for her paper in alternative and changing constellations. (2) The author of E3 who mostly has to work remotely from home needs minutes, to-do lists and agendas in order to contribute to the research work. Sometimes minutes, etc. are in the BSCW workspace, sometimes he has to call a colleague to get the current state of affairs and find out his tasks. Common planning tools such as shared checklists would be helpful here. Even BSCW use standards might improve the situation. Face-to-face meetings, telephone, telephone conferencing, email and the BSCW shared workspace system are used while various forms of synchronous collaborative technology - such as application sharing, chat, audio or video conferencing - are not yet used. However, technical support would not in itself provide the solutions. In addition, a practice of splitting up larger tasks and allocating the sub-tasks to individuals would be helpful. This is a matter of conscious and agreed-upon use of the obviously little time, focusing on certain objectives, necessarily at the expense of others, hence of the clarification of research priorities. It is also a matter of acknowledging that the work is geographically distributed as soon as one colleague has to work from another city. Individually and collectively clarifying, articulating and continuously examining interests and aims, capacities and limits helps to be reliable for others and prevents oneself from making unrealistic commitments. This becomes especially obvious in E2 where a clear agreement had been arrived at for generating a logo for which an enjoyable procedure was invented and initiated supported by the creative use of an available and appropriate technology, the BSCW system. Yet, the process did not work without persons signing up and taking responsibility for sub-tasks.

It turns out that the individual authors have formed *work routines* that are functional in many respects, e.g.: (1) In E2 and E3 the authors describe themselves as regularly checking and writing emails and often looking in the BSCW system. (2) The author of E3 has routines of finding out what his tasks are and prioritizing them. (3) In E1 and E3 the extensive and successful use of checklists is described. (4) In E3 the common habit of writing agendas and minutes of the weekly meetings and making them accessible to all group members in a BSCW workspace is referred to. (5) E3 is about the habit of discussing theses, papers and PD procedures on a weekly basis. (6) In E3 and E4 habitual work-related telephone calls are mentioned. (7) All episodes contain sections about the desirability and practice of commenting on each others' work, especially paper drafts. Yet, the need for the establishment and improvement of more and other routines is also obvious, for example: (1) The minutes in E3 that are accessible via BSCW are not complete and the author has to call his colleague. (2) For a long period of time the meetings agreed upon in E4 could not take place. (3) The deadline for the logo search contest in the meeting minutes in E2 does not warrant anybody to contribute to the process. In any case, work routines have not only to be established and practiced but also to be continuously examined regarding their suitedness, for example: (1) In E3 the author would have needed all minutes, including all task allocations, from the last meeting; the habit to call his colleague in such cases is not the worst substitute. (2) In E4 an alternative to the meetings agreed upon is so necessary and urgent that the author enforces a new practice of meetings in other constellations than originally planned. (3) The situation of not having contributed to the logo search process in E2 would not have occurred had the group had a habit of delegating the logo creation to a professional logo designer. Meta-routines for repeatedly examining and revising routines have to be established.

All episodes contain allusions to *personal accountability and the individual and collective organization of work*, for example: (1) In E1 and E3 the authors are keen on not forgetting important things and tasks. (2) In E2 the author regrets his and his research group's unreliability. (3) The author of E4 finds herself in a situation where an important agreement cannot be followed by her colleagues. Again, good use practices for the use of already available technologies such as telephone, telephone conferencing, email and BSCW and additional technologies such as electronic checklists and synchronous cooperation support provide chances for improvement. And again, conscious practice regarding the division of work, the collaborative structure, the use of time, research priorities and geographical distribution is necessary.

All episodes somehow contain allusions not only to the desire but also to the realization of work practices that guarantee rest, recreation, the further development of one's working capacity and enjoyable work results and processes (*sustainable work practices*), for example: (1) The author of E1 mentions the necessity to sleep and resume the preparation for his business trip the next day. He also cleans his home and workplace before his trip, which means that he can feel comfortable when he returns. (2) The author of E3 mentions that he cooks dinner after work. (3) In E2 the author tells himself to return to his agenda for that day instead of remaining in his mood of anger and disappointment. At various points enjoyable work practices that bring about good results are mentioned, for example: (1) the long and interesting telephone conversations in E3 and E4; (2) the playful utilization of resources: instead of disappointment about the repeatedly cancelled group meeting the author of E4 initiated enjoyable and constructive two-by-two meetings; and (3) in E2 the logo contest including a bottle of champagne as an incentive is a playful and enjoyable procedure. Some of the sustainable work practices in the episodes seem to rely on the absence of hierarchy or at least require extreme mutuality, e.g. in the followed research interests or regarding honesty.

In some cases, the attempts of utilizing (making ready-at-hand) and *making sense of the present infrastructures* - of *inhabiting common information spaces* - fail. This is for example the case in E2 where nobody took the time to contribute to the logo contest. Obviously, pertaining routines, a division of work and the allocation of responsibilities were missing. In other cases the utilization of existing infrastructures was partially successful. This is the case in E3 where some minutes and results are in the BSCW workspace while others are missing. Rules, routines, conventions and/or commitment would have helped. In cases of imperfect collective utilization of resources, alternative means and practices are necessary, for example: (1) The author of E3 calls his colleague after he was not able to figure out his tasks from the materials in the BSCW workspace. (2) After a long time of waiting for a group discussion to take place, the author of E4 eventually sought exchange in other, currently viable constellations.

FUTURE PERSPECTIVES AND CONCLUSION

Obviously, Narrative Transformation was viable so far and brought about useful results. The participants have established a design practice in its own right. It should be mentioned that this inquisitive, instructive and constructive process has been enjoyable. Formerly an abstract concept, the term "infrastructure" has become a lively guiding category. The group has already written follow-up episodes, installed groupware and tried new cooperative practices. Participants have not yet engaged in PD activities such as mock-up design and activities from Software Engineering, Requirements Engineering and Participatory Design. They have been in the process of deriving practical ideas from the episodes and experimenting with the preliminary results. It turns out that the attempted improvement of infrastructures is strongly related to the desired achievements of the participants and with the cooperation modes - practices, structures, etc. - that are feasible in their settings. Without explicating the desired achievements and realistic modes of cooperation, attempts at improving infrastructures are pointless.

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The performativity OF DESIGN
- participatory design of new practices

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ABSTRACT
This paper will discuss consequences of different theoretical approaches to practical design work. A special concern is to understand group- and teamwork from the perspective of language and speech-act analysis – in contrast to the perspective of behavior and performance. Does focus on language give us the understandings we need for building up a good co-operation in design teams? The paper questions if focus on language can give us understanding of hidden and underlying phenomena that have relevance to design work. How can we capture non-verbal resistance and power games in design groups? The notion of *performativity* used in anthropology, sociology and cultural history is discussed as a tool to capture the situational adjustment, resistance, display and evaluation that normally have influence on collective co-operation.

Keywords
Philosophical foundation of design, language-games, performativity

INTRODUCTION
This paper addresses the problems of establishing a collective spirit and common goals in groups established to do participatory design. These groups are constrained to co-operate and produce a common product – even if their interests are conflicting at some levels [4]. In Norwegian research and development based design projects user participation is highly recommended. Still the problems of transforming multiple interests into one design solution are poorly discussed. Participatory design is challenged by a variety of expectations, and the members of the design group have to sort out both a collective goal for their co-operation, and a collective way of gaining this. All this occurring within frames of time and money that do not consider the complex problems of collective processes.

Most participatory projects of today involve multiple disciplines and professional groups among the designers. Negotiations and conflicts are no longer related only to the gap between designer and user [14]; gaps related to multidisciplinary and cultural conflicts are also part of the processes in current participatory design projects.

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One consequence to this multidisciplinarity is that diverging concepts, methods and techniques may exist side by side in one project [12, 13]. But multidisciplinary relationships can also bring gaps and collisions among designers, as there are gaps between designers and users. The work to establish a collective spirit and a common goal should therefore be oriented towards a group of design actors – whether they are designers or users is of less concern.

How can designers learn to involve and understand different translations in multidisciplinary groups? How can designers build up their ability to attend to what Klaus Krippendorf (1995) calls second-order understanding: "By taking the meanings of others as a fundamental starting point for design, designers must proceed from their understanding of users` understanding. Which is understanding of understanding – or 'second-order understanding'" ([16], p. 160).

People act and speak according to their present knowledge and experiences – and in compound groups people are dependent on co-operative, interpretative and manipulative skills to communicate and align diverging views on the design. How can designers develop sensitivity towards these invisible, not-articulated and subtle influences on collective co-operation in PD projects – such as uncertainty, mistrust, individual intentions and silent resistance? To be aware of these, and to pay attention to the realities lying behind people's reactions might be among the most difficult things a designer can do. This paper discusses whether the focus on language-games is sufficient for understanding conditions that are relevant for the design – but that are not outspoken.

SOME CHALLENGES OF COLLECTIVE DESIGN WORK
The background for this discussion of the philosophical foundation of design methods builds on a study carried out

2000-2001, related to research and development of net based learning facilities for work-related further education. The examples here will be taken from that study.

The study followed two pilots of seven in a participatory-based research and development project. The design team consisted of practical pedagogues from a union-related competence centre for further education of graphical workers, pedagogical researchers from a university and a research institution, as well as system developers from two different IT research and development institutions. The practical pedagogues were responsible for deliverance of the content, as the systems developers were responsible for proposals on tools and technical systems. The remaining division of roles in the pilot work was based on negotiations in progress.[1]

The end user participants in this pilot project were from a middle-sized graphical firm[2] with current production fully based on paperprint. The changes of the publishing market motivated the management group to accept participation in the project. Still, among the graphical workers the motivation varied. Scepticism, especially among the older employees, was related to transformations that were planned to fit the market and towards participatory development projects as such. The graphical workers had some years earlier been involved in a participatory project for adaptation to new ISO standards in print – a project that failed because of lack of response from the management group. Reminded of these problems of co-operation with the management group, some of the employees were sceptical of the project. Because elaboration of this point would be a sidetrack to the main theme of this paper, suffice with noting that scepticism towards user participation had its historical reasons.

In the beginning the participants were active and engaged in the work, although negotiations and conflicts that might be characteristic to R&D-based projects appeared. The execution of systems development methods such as scenarios and storytelling is of special interest here, since one of the main research goals was to experiment with design methods that would stimulate user participation. Storytelling and scenario writing were expected to activate the end users to reflect on their own learning, and on how changes of production processes would follow the implementation of the system during the project.

In the project storytelling was meant to communicate existing working and learning processes, while scenario writing was meant to help users to reflect on future learning by help of net based learning facilities. Both storytelling and scenarios were presented as specific methods of systems development, and were demonstrated by examples.

It was a problem that the designers concerned with development did not find scenarios and storytelling interesting. These methods were therefore defined as a special interest of the system developers. This scepticism and the frames of time that were set for the project, were reasons why the system developers were to present a lot of information during the session where scenarios and storytelling should be done. For the participants this turned out to be an overload of information, and they stopped the session by saying that they were confused:

"I do not understand anything.. .and I feel....that there are choices of language....and preconditions and frames of reference in communication... and again I have to tell that we graphical workers are simple people, and we think practical, and we think about execution and we think concrete" (head of participatory design department in transcribed video clip from design session 3).

After this breakdown in the design work, the project leader stopped the scenario experiments arguing that these methods confused the participants, and by pointing to the difficulties of communicating why storytelling was useful in the design work. Instead the project leader based the participation on group interviews in the design seminars, asking for wishes and needs in the learning process. By this, the research on methods of participatory design was neglected, and the sessions took a direction towards development.

So why did system development methods cause such trouble for the other designers and participants in the project? Many interesting aspects of multidisciplinary and cultural diversity, conflicts in use of methods and not least of power relations, are embedded in this incident. The question that will be explored here is if the perspectives of language and language-games give a sufficient understanding of this breakdown.

CREATING THE COLLECTIVE DESIGNER

In the work to build a philosophical foundation for participatory design of ICT, several approaches have been

[1] The pilot project started with a change of project leader with responsibility for both the project as a whole and for the specific pilot work. The new project leader had minor knowledge of participatory design traditions of system development, on which the project was principally based. Her background was in union-based educational politics and less from research and development. Some of the conflicts described below might have been avoided if the project management had been more trained in participatory research and development projects. Still, the empirical case probably gives a good picture of the realities of Norwegian research and development projects of today.

[2] In the Norwegian context middle-sized firms have about thirty employees. The co-operation in the NEMLIG project (Net - and Multimedia based Learning arena) concerned ten employees from the design department and the repro department.

proposed. A concern with learning and communication arose at the same time as the general focus of system development moved from being attached to the product, to being related to the process [11]. Several theories of design were proposed, founded in hermeneutics, phenomenology and linguistics [6, 7, 8, 9, 23]. Relevant here will be the understandings of design work as based in cognition of language and language-games.

Language and cognition

The perspectives on language in the work of Winograd and Flores [23], was inspired by speech-act theory proposed by J. L. Austin ([1], p. 180). Language is here understood as the elements by which a culture and a society creates itself, and the main focus was put on classes of utterances or performatives, and their relation to context. The fundamental belief of this approach is that "Nothing exists except through language" ([23], p. 68). Austin's speech-act analysis was therefore used as one way to capture categories of utterances and breakdowns in the interactions between humans and computers.

In anthropology the focus on language is based on the assumption that there is a deep connection between patterns and structure of language and perception, thoughts and culture [19]. However some anthropologists emphasise language more as an embroidery on top of the deeper patterns of consciousness, which can exist independently of symbols and language [19].

Another track of the focus on language is Wittgenstein's philosophical work on the social aspects of language - as language-games and rules of play. This interactional aspect of language has been used as a theoretical frame for participatory design [7]. By using language-games as a model, Ehn proposed to understand descriptions in design as objects for reflection, rather than as correct reproductions of realities. Language, and the meaning of language, is in this view dependent on its use – in the same way as systems descriptions are determined by their use. Descriptions of practices have then to be understood as social products, as the knowledge embedded in the practice has to be shared between performer and observer.

This insight inspired a bend away from the formalistic methods of systems development, towards more ethnographic and experiment based design work. The focus on the social and interactive language-games is proposed as a way to realise that descriptions never give exact pictures of users' practice. This ethnographic standpoint represents a parallel to the understanding of language as action, as it emphasises descriptions not as exact facts – but as social facts.

Ehn`s suggestion of using the perspective of language-games embedded a shift in the understanding of methods and techniques in system development, as they became methods for learning and reflection, rather than for determination of systems requirements. Mock-ups, scenarios and work organisation games were proposed as alternatives to traditional systems descriptions – and the information attained by these methods was not expected to be "correct", but to be typical or recognisable as phenomena [7].

As we will see in the empirical example below, understanding and accepting the language-games of the other is a big challenge in multidisciplinary collectives. Even in using scenarios or storytelling – where "correct" answers are not possible, neither they are the goal - expectations and experiences of the participants can produce unmanageable boundaries and contradictions. Still, the argument in this paper will be that by focusing not only on the language-games, but also on the performance of the actors involved in the design process, valuable information will come up. "Incorrect" answers also are interesting, because they represent social facts of the culture that is studied [19].

LANGUAGE OR PERFORMANCE

The focus on practice in systems development and anthropology arises out of the wish to understand human behaviour based on its rules and regularities. Another perspective is to concentrate on the actions that are not prescribed by rules or habits, as in situations where no existing practices can possibly guide actions. In these cases the focus on practice can be related to an interest in the emergence of collective practices based on experiments, improvisations ([3], p. 199), or on negotiations [17].

Mainly the focus on practice "focuses on that aspect of human life and activity which is structured largely through unquestioned, unthought habit, through which human beings normally carry out the business of living both in everyday life and in important strategic situations" ([20], p. 199). The focus on language-games then represents one way to capture the habitual, customary ways people deal with situations in their daily life – the question is if this focus is suitable for studies of improvisations and strategic ways of dealing with new and unknown situations.

As an offspring of the philosophically based interests in language from Heidegger, Gadamer and Wittgenstein, and the speech-act theories developed by Austin ([1], p. 180), an interdisciplinary interest has grown concerning the performative aspects of human communication and actions. Performance studies constitute a research field where discussants from social sciences, particularly anthropology and sociology meet with humanistic based studies including ethnology and theatre studies. The main stanza for this approach is that “human culture is in large measure performative, that is, activity consciously carried out and presented to others in order to have some effect on them” ([5], p. 141).

Performativity studies are understood as an alternative approach which “deals with actions more than text. The habits of the body more than structures or symbols, with illocutionary rather than prepositional force, with the social construction of reality rather than its representation” ([20], p. 194). This approach is a way to talk about the competencies, abilities and skills that are needed in communication between people [2], and a way to talk about transformative practice, either as reinforcing cultural givens. Or as potentially subversive [21], as these transformative practises are seen as deeply context-dependent [15]. Common to all the approaches on performativity is the illumination of the behavioural part of using language, as language is used for relational reasons, in a collective where reality is socially constructed [20]. The focus is based on theories related to negotiation and participation [22], creation of collectively constituted meaning [15] and “the creative, improvisatory edge of practice in the moment it is carried out” ([20], p. 199).

Applied to the discussions of design, performance theories can be understood to approach the negotiations and the collective processes of design. It proposes an alternative approach to the focus on communicational tools and techniques, as in speech-act perspective or language-games. Approaching design by its performativity gives us therefore an occasion to analyse the transformations that are at work in the design collective, as transformations to enter into the framed behaviour for example in a design seminar. Or transformations in the ensemble of a design project, as abilities to get other people’s attention and to transform their views.

All these abilities are basic in co-operative communication, and are in consequence also points for analysing design executions. These aspects very much touch upon the abilities to create a collective, and should also be themes of reflection by the individual designer, the participant and the design group during and after a design process.

ANALYZING PERFORMANCE

While observing the video recording from the design session in question, and reading the transcriptions of the recordings it is hard to identify when and where the breakdown actually took place. The video shows that during the last 20 minutes before the graphical workers asked for a pause in the workshop, they became silent and were listening to the discussions between researchers and developers. Still, it is difficult to define what actually caused their confusion. The visible breakdown – the point where the participants are proclaiming that they are confused – is the first incident after a break in the workshop. The real breakdown had happened long before that. This analysis therefore follows the different threads of the breakdown, departing from the problem of introducing storytelling to the design group.

One striking experience with the introduction of storytelling in the project was related to the way storytelling and scenarios were presented. They were presented in the form of writing rehearsals, demonstrated by stories of the existing production processes that the system developers had written, that were handed out on paper. The graphical workers refused the story that the systems developers had composed, saying that it gave a too simple picture of their production processes:

"The troubles that are appearing in the ongoing production process are camouflaged in this presentation... we all know that this is a big part of our every day life... to solve problems" (head of participatory design department in transcribed video clip from design session 3).

The participatory design department was eager to tell the same story in a more realistic way. Their responding story arrived on e-mail some weeks later, integrating dependent clauses that described all the exceptional cases and potential problems along the production line.

The system developers, though, were not content with the resulting story, and decided not to use it in their design work. Later they explained that they found the story too general and not sufficiently concrete, and therefore not suitable:

“We were concrete – and we wished to be concrete – while they wished to describe all…all kinds of problems and exceptions in their story. So, there was something about the form – which we did not succeed to communicate to them. They should have written short – or the same length - stories that showed another aspect... instead, we got a story that was a mixture of concrete and abstract procedures” (system developer in transcribed interview).

Several reasons could be found for this different understanding of abstract and concrete; one of them is that the storytelling made visible cultural diversities in a way that was not acknowledged. The storytelling experiment was colliding with the existing storytelling culture among the participants, which is mainly oral. The graphical workers in the firm do tell stories, and they do also exchange knowledge and experiences by way of telling stories. But they are not in the habit of writing them down. They were forced into a communication form that was unfamiliar when they were expected to tell stories in writing. This point is also well supported by the work of Julian Orr [18].

Interpreting the problems with the stories as related to multidisciplinary gaps rather than as a matter of mutual understanding, the system developers did not realise that the story told by the graphical workers was based on interpretations of their own story. The mixture of “concrete and abstract procedures” was what the graphical workers thought the systems developers wanted. By their use of dependent clauses and exceptions, the graphical workers underlined that the production was complex and not easy to generalise in the way it was done by system developers.

In the background of this abstract–concrete mixture, a negotiation of the premises of the design work also could be hidden, as the methods of the collective was determined by the systems developers, and as the reasons for telling stories of existing practices was never made clear to the users. The graphical workers were very well aware that new media design had totally different production processes than paper production. Being accustomed to change connected to new technologies, graphical workers have a long history with changes connected to new technologies (see e.g., [7] or [10]). Telling stories of existing practices seemed to the graphical workers obscure and a waste of time. The head of the graphical department underlined that he understood that the stories were important to the system developers, and that they probably were *"familiar with understanding this kind of stories"* (head of participatory design department in transcribed video clip from design session 3).
This was even more a sign that the story they wrote was an attempt to answer the system development initiative – a relational answer. By not using the same style as the system developers – but still responding to their initiative, the graphical workers negotiated the collective understanding of their work and competencies. Resistance towards the system developers` premises was demonstrated within willingness to please, based on interpretations of the goals of the systems developers.

DISCUSSION: THE PERFORMATIVITY OF DESIGN

So how do we get a full understanding of the breakdown that storytelling triggered in this pilot work? We see how the perspectives of language-games can be used to discuss the different comprehensions of abstract and concrete, as the diversity was visible both in the written stories and in the research interviews. By focusing on language-games, we understand that the system developers and the users never came to understand the language-games of each other. But we also can sense a resistance to accept the language-game of the other in the project. As for example when the system developers did not accept the responding story told by the users, or as the graphical workers used storytelling to display the system developers’ lack of understanding of their practice.

The storytelling demonstrate how collaboration in design collectives is not only challenged by the need to understand the language-games of each other. It is also important to keep in mind that a lot of information gets displayed in subtle ways, and that language-games can be displayed as an embroidery of these - for strategic reasons.

The storytelling is here connected to different performative aspects:

1. how the system developers introduced the method to their audience – the users
2. how the users made use of the storytelling to suit their own intentions and strategies for the design work
3. what expectations both actors had toward the result of the method
4. how multidisciplinary groups of designers perceive working methods and goals of the other

By focusing on the performativity of the users here, we could have asked for the rationales behind their demonstration of the other realities in their story. We could have come to the conclusion that they did not respond with a story that resembled the story of the system developers, because they might not have understood the rationales for describing existing working practices. They knew that the new practices of web publishing differed so much from paper production, and had a hard time understanding why the system developers took departure from these irrelevant practices.

But we might as well have identified a resistance towards system developers` dominance, or towards the forced user participation in the project as such. These aspects though are not evident by using only the perspectives of language-games, as they are hidden in the performances of the actors.

CONCLUSION

The storytelling case describes how construction of reality is fundamentally relational and negotiable. And how this negotiation also consists of not-outspoken, invisible, tacit and silent displays and evaluations that are as transformational as the outspoken. Analysing these performative aspects is proposed to be a way to capture the relational and responsive sides of design.

Design is the point where worlds collide and disciplinary categories dissolve and melt into new ones. If the collision is caused by diverging perceptions of, for example, abstract and concrete or of the underlying values that are negotiated – then other perspectives have to be employed as well. The negotiation is not only going on between professional groups or between diverging translations of the participants in the design group – but between diverging sets of cultural, social and commercial values and politics.

The perspective of performativity is proposed here to give an understanding of “the particular improvisation of a practice in a particular situation, its particular turn of significance and efficacy for one self and others at the time – in the moment where habitude becomes action” ([20], p. 199).

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CAD Models as a Co-Design Tool For Older Users: A Pilot Study

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ABSTRACT

The UK population is ageing, and currently, the design needs of older adults are not being met. Increased older user participation is required in design. It is proposed that CAD (Computer Aided Design) and Rapid Prototyping (RP) models can be used as a tool to facilitate user involvement early in the design process. This paper explores the potential for a computer-aided participatory-design process for older adults. It questions older users' understanding of CAD models of products in terms of 'physical product properties' such as perceived size, weight, colour, surface properties and 'subjective attributes' such as perceived quality. It aims to establish how far older adults are able to understand CAD models shown on a computer screen. This work-in-progress paper discusses the current literature in relation to ageing and CAD, and goes on to describe the methodology for a pilot study, which forms part of the first stage of PhD research.

Keywords

Ageing, Computer Aided Design (CAD), Ergonomics, Design, Rapid Prototyping

INTRODUCTION

By 2020 half the UK adult population will be aged 50 or over [2] and this trend is shared by other EU countries. Globally, the number of people aged 60 years or over is expected to triple by 2050, increasing from 606 million currently to 2 billion [15].

With governmental policies encouraging a large proportion of the population to live independently for a longer period of time, it therefore makes commercial sense for manufacturers to produce products that are suitable for these users, as part of the mainstream design process.

Design for a 'grey market' constitutes many of the opportunities for new product development, and coupled with advances in manufacturing technology, the potential market is continuously growing. The market can be extended further by taking an inclusive approach to the design of new products, whereby no part of the user population is excluded by inappropriate design. Adopting a 'design for all' approach ensures that the least able can use a product, thus maximizing the number of potential users. This approach also creates products which more able users may prefer to use.

Older users of modern products experience changing physical, psychomotor, sensory and cognitive capacities related to the ageing process. As such, they often require solutions, which are sensitive to their changing needs and extend their period of independence and social participation. To achieve this, it is desirable that older users play a role in the design of products they wish to use, thus informing designers of the problems associated with ageing. New product designs should be inspired by their intended users' habits, needs, environment and capacities relevant to the use of products [18]. UK designers already involve end users in design but this information is often provided too late in the design process when it is difficult to solve problems [10].

The UK Foresight Manufacturing 2020 Panel final report recommended that manufacturers should focus on high value-added products and support research into more highly customised products [7]. Manufacturing products that are tailored to a specific user-group such as older adults fits both of these strategies. The technologies required to achieve these aims are becoming available in the form of more representative CAD models and rapid prototyping systems. There is therefore, a convergence of

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needs from the directions of the user, the designer and the manufacturer.

The focus of the research project is to evaluate the potential of designers collaborating with older adult users. This provides a mechanism for giving users a voice in the design process and an opportunity for the stakeholders in product development to meet, work with, and understand their users. The use of Computer-Aided Design (CAD) and three-dimensional physical modelling to produce appearance and functional models is proposed as a way to facilitate this.

This paper reports on a work in progress pilot study forming part of the first stage of PhD research. It builds upon previous work by the Loughborough team in the area of inclusive design [1].

LITERATURE

Who are 'Older People'?

The term 'elderly people' is no longer relevant, as this has the effect of setting apart a significant proportion of the population on the basis of age, even though that proportion can include two generations. As life expectancy extends and birth rates diminish, active life well into retirement is now the norm. The term 'elderly people' is therefore inappropriate when discussing people aged 50 to 100. The terms 'older people' and 'older adults' are the preferred vocabulary to use when referring to people who experience developmental changes after the age of 50.

Computer-Aided Participatory Design

The principle of participatory design is that the end user has an important contributing role in the development of products they will eventually use [11, 5]. In the literature there are a number of studies involving older users in design [4, 6], but these mainly involve group activities focusing on product evaluation rather than on design. Much of the current literature on participatory design deals with information systems, as opposed to the design of physical products [for example 9]. There is therefore an opening for research into the role that CAD, RP and customisation can play in the participatory design process of physical products. One study of users proposed that more systematic studies are needed into the variables specific to human perception. That is, how humans perceive images on a computer screen [20].

Few other studies have been found to address the issues of using 3D CAD modeling as a co-design tool with individual users. It has however, been claimed by Mitchell [14] that CAD has few advantages over 2D drawings on paper. An approach whereby designers generate designs as 2-dimensional drawings and have potential users comment on them was criticised as offering little scope for laypeople to understand them, thus having no meaningful input in the design process. The authors disagree with this viewpoint as representational CAD technologies have become increasingly advanced over recent years and offer considerable scope for involving users early in the design process. This is not to say that CAD models are going to replace drawings, cardboard mockups and other modeling media, but it is simply another representational tool available to the designer.

Mass Customisation

The participation of users in the design process is leading to an increasing customisation of products. Manufacturing industries are seeing manufacturing processes going back in time to a pre-Fordist paradigm where products were created individually by collaboration between the producer and the customer. Users are now able to participate in the design process by customising their products; internet technologies are advancing this phenomenon. Products may be customised by the user after production; for example, clip on mobile phone covers, or products may adapt to the user; such as intelligent systems in cars. Crayton [3] refers to these as 'soft customisation'. It is also possible for end-users to interact with the design and manufacturing process to alter the core design of the product, perhaps choosing from pre-defined, configured choices.

Computer Aided Design (CAD)

CAD and computer-aided-manufacture (CAM) are transforming design processes as well as the aesthetic nature of the products that can be created [16]. The design software used by designers has moved from being a tool to being an intelligent environment that can guide and inform the design process. If a 3D CAD-CAM system is used, then the modelling stage of the design process can be performed on the screen. Crayton [3] recognises that with suitable refinements, technologies available to designers can be put in the hands of non-designers such as end-users. This would allow users to configure, or co-design products by interacting with highly flexible manufacturing systems. CAD models would be the obvious interface.

Formats of CAD Models

CAD solid models evolve through various formats in a design process. For example, 3D CAD allows the designer to model the product in three dimensions rendered as either a solid form or a 'wire-frame' construction. These wire-frame models can be shaded grey to give them depth and form. Later in the process, the models can be rendered to represent actual colours and materials, shadows and reflections. The pilot study discussed in this report aims to test how far these display formats can be understood by older users.

Rapid Prototyping

Rapid Prototyping is the collective name given to a range of processes used to create actual size components using 3D

CAD data. RP is opening up new design opportunities due to reduced build times and product customization, and can be compared to 'printing out' an object in three dimensions, providing inexpensive tactile feedback to designers and users. Stereolithography is an example of such a process where lasers are used to build models from fine skeins of liquid resin, and can be ready in a matter of hours [16]. It is argued that the potential of RP is not how realistic the output is, but the speed in which the virtual computer world can be replicated in a physical model [21].

Sensory, Cognitive and Emotional Variables

In the context of this research, it is necessary to know how much older users can understand from a CAD model. By this, it is meant whether they can identify physical properties such as a product's size, weight, colour and surface properties and subjective attributes, such as perceived quality and product personality. To identify products, the sensory variables of vision and touch are used along with the subjective elements of user experience.

Physical information about products is perceived by one, or a combination of the five senses; the senses of vision and touch being the most commonly used. In the literature, there are many descriptions dealing with the changes that take place in the eye and the neural mechanisms as people grow older [8, 17]. The lens becomes thicker, more yellow and opaque, visual acuity and pupil size diminish, and there is a heightened sensitivity to glare. Spatial vision and motion perception also change, as the individual grows older.

In human-product interaction, touch is important for the ability to locate, manipulate and identify products manually. Touch supplies information about products that is not available to other senses, such as softness and temperature. Diminished tactile sensibility has been reported with increasing age [19]. The number of receptors in the fingertips decreases and their morphology changes, resulting in a loss of tactile sensitivity.

In addition to identifying physical properties, users also experience emotional attachments with products [12]. Properties such as enhancement of quality of life, status and cultural significance are assessed through user experience, aspirations, memory and familiarity.

METHODOLOGY

The methodology describes work in progress addressing how far older users can understand physical and subjective product properties from different formats of 3D models (CAD models and physical models). The broad objectives of the study are:

- To determine how far older users are able to identify a product and its physical and subjective properties from viewing a 3D CAD model of it on a computer screen.
- To establish which format of model older users most relate to, in terms of their physical and subjective product properties.
- To determine how older users perceive the realism of the CAD and rapid prototyped models when compared to the actual products they represent.
- To begin to establish the potential of involving older users as part of the designing process.
- To gain experience in conducting studies using older users, including the development of a common design vocabulary.
- To gain experience in producing models through the use of CAD and rapid prototyping technologies.

Sampling

Twelve participants, all over the age of 50 will be used in the study (6 males and 6 females). 6 of the participants will have had some previous experience of viewing computer graphics. Participants will be asked to wear the glasses or contact lenses that they would normally wear when viewing a computer screen. The participants will be recruited through contacts (staff and students) from Loughborough University.

Products and Modelling

Small hand tools for gardening (a garden fork and a pruning saw) have been selected for the pilot study because:

- There is an above-average participation in gardening in later life, which increases in importance as people grow older and have more free time [13].
- Gardening is an activity which people can continue to enjoy into old age and many of the products available are suitable for use by older or disabled users.
- Most people are familiar with the types of products used for gardening, even if they have never used them themselves.
- The products are relatively easy to model on a CAD system due to the small size and small number of moving parts.

3D solid modelling software called Pro Engineer is to be used to model the products. The CAD models will then be produced as physical models using rapid prototyping techniques (the particular technique will depend upon machine availability). This will allow participants to also evaluate 3D physical models; in contrast to viewing 3D models on a computer screen. Two versions of the rapid prototyped models will be used in the trials – one will be considered 'unfinished', as it will not be painted or polished. The other will be considered as 'finished' as it will be made to look as much like the actual product as possible; for example, painted, and filled inside to represent the correct weight.

Product Properties

The product properties, which will be the focus of the pilot study discussed in this report, are summarised in Figure 1. For each format of model, these properties will be used as the basis for data collection.

Physical Properties	**Subjective Attributes**
Function - What the product does	Quality
Size - The perceived size of the actual product	Cost
Weight - The perceived weight of the actual product	Personality
Surface Properties - Materials, texture, roughness, thermal qualities	Desirability, Status
Colour - The perceived colours of the actual product	Aesthetic appeal
Design Features - Specific features identifiable from the model on the screen	Previous use, familiarity and need

Figure 1. A summary of the product properties.

Data Collection

Semi-structured interviews (lasting a maximum of 2 hours) will be the main method of data collection. To maintain the richness of participants' responses, open-ended questioning will be used, guided by a set of core questions and issues to be explored. Prompts will be used to elicit more specific information. Figure 2 shows the different formats of CAD models to be tested. The participants are divided into two groups. Presentation of the products to Group A and B will be balanced to minimize any learning effect.

Model Formats	**Group A**	**Group B**
	Participants 1, 3, 5, 7, 9, 11	Participants 2, 4, 6, 8, 10, 12
2D orthographic line drawing	Fork Pruning saw	Pruning saw Fork
3D grey-shaded model	Fork Pruning saw	Pruning saw Fork
3D photo-realistic model	Fork Pruning saw	Pruning saw Fork
3D physical model (unfinished)	Fork Pruning saw	Pruning saw Fork
3D physical model (finished)	Fork Pruning saw	Pruning saw Fork

Figure 2. Presentation of model formats.

Trials Procedure

The trials are divided into 3 main parts:

1. Introduction interview to establish the participant's user profile, their previous computer experience and that they have suitable eyesight.

2. Identification of physical and subjective product properties from different formats of CAD and rapid prototyped models.

3. Ranking the realism of the product properties shown by the model formats against the actual products they represent.

Part 1

Questions are asked which build a socio-economic profile of the participant and they are asked about their previous computer experience. Two simple visual screening tests are performed to establish that the participant has suitable visual acuity and no colour deficiencies, which would affect what they see on a screen.

Part 2

Participants are shown the line drawing of the product (fork or pruning saw) on the computer screen. They are asked to describe what they can see. Prompts can be used to elicit more information, until as much information about the physical and subjective product properties has been collected. Reference props such as rulers, weights and material samples are available to be handled to assist the participants in describing size, weight and surface properties. Once as much detail as possible has been collected, the next format of CAD model (grey shaded) is shown on the computer screen and participants are prompted using the product properties (Figure 1). The process is then repeated for the fully rendered CAD model and the unfinished and finished 3D physical models. When all the questions for the first product are completed, the same questions are then asked of the second product (pruning saw or fork). To capture participants' subjective views on the products, they are asked to describe the product by imagining it is a real person. The investigator will use appropriate prompts to elicit this information. The trials will be video recorded in order to capture the participants' responses and body language.

Part 3

Participants are shown the 5 representations of each of the products as paper printouts. They are asked to consider each of the properties of Function, Weight, Materials, Size, Usability (ease-of-use) and Quality in turn and rank the images in order of which one gives them most information about that particular property. The product representations will be ranked accordingly.

Closure

The trial will close with a brief structured interview to confirm how the participants felt about the trial and if they experienced any difficulty viewing or handling the models.

CONCLUDING REMARKS

The need to involve older users in the design process has been discussed. 3D CAD and rapid prototyped models have been identified as possible tools to achieve this, but first, it must be established how far older users are able to understand CAD models. The study discussed in this paper aims to determine if older users are able to identify a product and its physical and subjective properties from viewing a 3D CAD model of it on a computer screen and to ascertain which format of model allows older users to identify the most product properties.

The authors expect to find that fully rendered CAD models and finished rapid prototyped models will allow older users to report the most product properties. It is thought that 2D line drawings will provide the least amount of information about product properties. It will be interesting to see how older users perceive grey-shaded CAD and unfinished rapid-prototyped models. The trials will take place in May-June 2002, and preliminary results will be reported at the conference.

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Empathy Probes

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ABSTRACT
Design empathy is needed when going from rational and practical issues to personal experiences and private contexts. Probes are specifically designed material packages given to the potential users to document their private lives, contexts and experiences. This paper describes a case study of experimenting with the probes approach, combining it with interviews and a projective tasks. The study was done in collaboration with Polar Electro Oy. The aim was to gain a holistic and empathic understanding of the people who exercise for wellbeing. This paper describes the study and the gained experiences on building and sharing design empathy.

Keywords
User centered design, user study, probes, collages, self-photography, design empathy

INTRODUCTION
Design empathy is a skill often mentioned by leading human factors and designers [1, 12]. Design empathy means that people are seen and understood from where they stand, not as test subjects but as persons with feelings. To get an access into the subjective issues marketing or user research reports are not enough but design empathy - a personal contact and connection with the users - is also needed [12]. It has two directions: towards the participants to create an empathic and respectful dialogue and towards the designers to support empathic understanding.

Sanders [10] divides user research into three areas according to the focus and the kind of information that can be acquired with the methods: say, do and make. Say and do relate to interviews and observations. The make-tools are physical or visual aids to allow people to visualise and describe their expectations and dreams. According to Sanders these categories should be explored simultaneously to achieve an empathic understanding of the users.

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As information technology has become a part of everyday life, people carry and use personal technology devices in changing contexts. To be able to design for positive future experiences the designer has to understand potential users as well as their physical and social contexts. This means widening the scope from task focused usability to taking into account contexts, actions, feelings, attitudes and expectations. [9,13]

These wider contexts affect especially the user research conducted before concept development. In the first phase of concept design the challenge is to find fruitful starting points and questions to be able to formulate the design task [8]. It is difficult to set well defined aims for the user studies at that point. One has to start by probing the possible area to find opportunities and searching for possible signals for new directions.

To gain a larger view into the lifestyles of people and facilitate a better understanding of people's experiences, more traditional user study methods e.g. observation and interviews can be supported with other approaches [10].

The Cultural Probes, described by Gaver, Dunne, and Pacenti [5] was a fresh user study approach into the private lives of people in different cultures. In the Presence project, as the traditional methods were thought to limit the view into too specific and controlled areas, "the probes were designed to be an alternative to the more traditional forms of user research"[6]. The word probe suggests an automatic recording device that is sent to unknown territories where human researchers cannot go, from where it collects samples, and sends these back to the researchers.

The probes in this study were specially designed material packages given or sent to the people to support self-reflection and documentation. These packages contained disposable cameras, maps with instructions and stickers, pre-stamped postcards, and were generally aimed at providing a constant trickle of inspirational material to support a cultural understanding at the designers' end. Different items in the package were not designed to gather preset or specific information, but rather to be inspirational and provocative and project unpredicted views to the life of the elderly.

While Cultural Probes could be criticised for lack of formal analysis, it addresses user research from a concept design and designerly point of view, seeking for new opportunities rather than addressing problems [5][8]. Strictly theoretical methods have not been widely adopted by designers. Designers are influenced by the concrete things they can see and feel [3]. When the returned probes material is offered in form of visual stories the design team has a chance to review the material again to look for stimulation and ideas. The material supports thinking and serves as a memory trigger and as communication medium for ideation [2].

Our interest was to gain experience in using the probes approach in a context close to the design industry. Unlike in the Presence project, where the Cultural Probes were developed by the designers themselves, we were in a consulting position, between the participants of the study and the client company. This created a challenge of how to communicate the gathered data to the designers in an empathic and inspiring but at the same time usable and motivating way. Also, we did not want to send probes only to collect inspiring signals but wanted to experiment on combining the probes approach with interviews and make-tools in a process of continued involvement for a more holistic understanding [10]. Our emphasis was on using the probes kit to allow the participants collect data about their physical and social context, life style, attitudes, and experiences to be explained and discussed later in personal interviews.

THE CASE: HEALTH, WELLBEING AND EXERCISE

Being a heart rate monitor manufacturer, Polar Electro had an interest in expanding their knowledge of non-users, especially those who exercise for feeling good and being healthy rather than competitive sports. Their aim of the study was to look at the experience of well being and exercise from a wider perspective - to understand the everyday life of people, their feelings and motivations.

The amount of participants for this qualitative study was limited to ten and they covered ages from 24 to 71 and conditions from headaches to recent by-pass surgery. None of them owned or used a heart rate monitor.

Tuning in

The study began by researching exercise and nutrition facts for by-pass operation patients. At the same time the aim of the study and its participants were defined to match the interests of the company. Designing the probes kit requires an understanding of the area of the study, and the willingness to understand the informant. This willingness is the first stage in building empathy.

As health and wellbeing can be very sensitive issues, it was important to understand the feelings and the language of the participants and apply this knowledge to the probes material. A focus group was organised with half of the participants to open the discussion, erase our own possible preconceptions.

The Probes kit

Applying the example of other probes studies [5,14] the kit included a small diary booklet and a sheet of stickers, a disposable camera with a list of photography assignments, and ten illustrated cards with open questions. These were sent or given to the informants along with a stamped and addressed return envelope.

The purpose of **the diary** was to collect a set of daily routines and thoughts relating to health, well-being and exercise. Diaries provide tools for event documentation as well as reflection. To assist in the process of describing their feelings, a sheet of **stickers** was provided with cartoon faces and other little illustrations to do with everyday life, exercise, and the season of early summer. The use of the stickers was suggested but not expected.

The illustrated cards had a question on the reverse side with space for writing. The open questions were about issues of interest for heart rate monitor development e.g. how does exercising relate to social issues, how people achieve results, how do they reward themselves.

Some of the cards were about attitudes and facts, and were supported with a descriptive image such as a picture of a computer, a phone and a heart rate monitor. Some cards related to experiences and emotions had more provocative or suggestive images on them, such as a plateful of sugared cakes for a question about rewarding oneself.

The participants were asked to take **photographs** according to given assignments. As with the cards, some of the assignments were purely documentative, requesting pictures of the home and their information appliances, exercise environment. Other assignments required more interpretation and provided a possibility of emotional expression, for example "something disgusting" and "what do you see in the mirror".

Self-photography can be used in situations where the researcher cannot be present, and it collects visual information about the physical environment. Also, in allowing the informants to take the photograph, the choice and framing of the target becomes subjective. They can decide for themselves what things they are willing to show. One participant did not want to show any members of her family in the photographs and chose her subjects accordingly.

Interview

Each person attended a personal interview where the preliminary review of the results was validated and other issues arising from the material were discussed. The photos, now attached to an album, were leafed through picture by picture, and the informants told us about the things in the photos and other issues related to the study.

As a final closure, the participant was asked to build a **collage** describing their ideal wellbeing and exercising assistant. Collages are sometimes used in the beginning of the design process to find the spirit for the design and in user research and participatory design exercises to reveal dreams and emotions [10]. The materials were a large sheet of paper, glue, and cutout pictures and words from magazines related to exercise, life style, feelings, people, environment and products.

Analysing the material

This study and the gathered material were reported to the company by presenting the collected material and a report with descriptions about the participants as characters and arising themes and patterns on e.g. motivation, measuring, attitudes towards technology illustrated with examples from the material. To report these themes in a less digested and more empathic way and to bind the analysis to the collected material we used the original stories and words to illustrate them.

Communicating the results

Although there was no direct relation to an ongoing product concept development project, we wanted to experiment if the probes and the interview material as such could be used to find new points of views for a company producing heart rate monitors. We organised a workshop with a multidisciplinary group of people from Polar Electro Oy.

This study presents a limited number of people but in previous meetings with the representatives of the company it was found out that going through the material of 10 participants at once is too heavy and time consuming. We chose to experiment with the material of four informants with widely differing attitudes towards exercise. The first preferred exercising alone, with the second the motivation for exercise was mostly to meet friends and mates, the third was very duty driven, the fourth exercised for the pure joyful experience.

The diaries and other materials had not been designed for easy photocopying and distribution, and also the confidentiality had to be taken into account. The diary texts, card answers and exerts from the interview were typed and combined with sticker messages and pictures the participants had taken. These files were then sent to the company, printed out, and distributed to each participant before the workshop.

To ensure that the workshop participants read the material each had a small assignment that required them to think of the informant in an empathetic way, such as writing a card from holiday on their behalf or suggesting a horoscope. This assignment was found to be a good way of starting the workshop. It created an empathic and playful attitude, which supported the teams in the concept design phase. All the presented concepts reflected needs arising from the material in a human-centred way and raised a discussion e.g. about the relation of physical and mental well being and growth.

SUPPORTING REFLECTION WITH PROBES

Case specific material

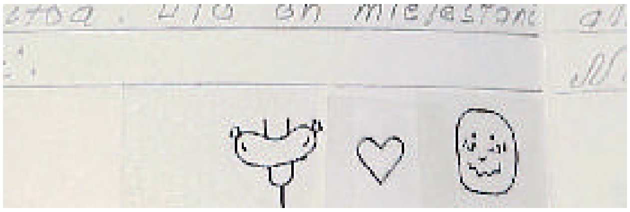
The probes material and the assignments are designed for the purpose. The empathy building process begins with designing the material, imagining the possible contexts of experiences, projecting designers' own ideas and questions about the research and design issues, and preparing a sensitive ear for understanding another person. In this case it happened by thinking about the issues related to exercising and heart rate monitoring as well as considering the values of life and exercising before and after a by pass operation.

The way the probes material is designed has effect: using ambiguous stimuli for users to respond to and allowing for expression verbally, visually and through action also enables the participants to express their emotions easier [10,14]. While having the material kit to document their life, the informants are attentive of the experiences and routines related to the issues being studied. To be asked to verbalise experiences, they become more aware of them [5]. One participant told us later that even after the study she thought what to write into the diary.

The diaries described daily routines and feelings of the participants. These thoughts with personal way of writing opened a subjective view into the life of each person. Some personal issues are easier to write than say aloud.

The stickers inspired some informants to make little humoristic or emotional messages. One informant explicitly told us later on that the stickers helped in communicating the feelings of the day. This suggests that providing people the possibility of easy to access illustrations makes the diary task more playful for the informants, but also more motivating and enjoyable for the reader, weather it was a researcher or a designer. The similar experience about the stickers and diary facilitating the feeling of empathy for the reader was remarked in another probes study. [14]

Figure 1. Stickers in a diary



The participants did not say explicitly that the illustrations on the **illustrated cards** had been helpful for answering the questions, some of them were not even sure whether they had seen the pictures at all. However, some of them commented a positive surprise when opening the package for the first time and finding the colourful cards. Having separate playful items in the package can affect the motivation of starting the documentation. The responses on the cards provided more detail about issues that were not expected to emerge from the diaries. Some of the issues asked in the cards, appeared, however, in the diaries: the material seem to have given food of thought and stimulation.

Photographs illustrated the life style of these people, their preferences e.g. in exercising equipment. This assignment was surprisingly thoroughly done by all the participants and they were eager to see their photos developed. They had enjoyed in playing with the camera even though some of the assignments needed thinking and effort.

Interview

The persons, their environment and experiences described in the diary became easier to vision through the photographs. However, the explanations of the meaning of the choices were important for understanding the pictures. The photographs also served as easy starting points for discussion, e.g. about making decisions for purchase or issues that had not been asked about at all. Through these **photo album stories** we were able to go deeper into interesting issues.

The collages were emotionally expressive and dynamic. The overall image communicated the ideal attitudes of the person. Through the collage people produced a visual and emotional explanation of the personal elements of well being: nature, social relationships, food, exercise, pleasure, a positive attitude, and the harmonious balance between them all. However, we learned that our interpretations of single pictures were sometimes incorrect. Again the specific reasoning behind the choice of particular images was the key to a deeper understanding of the collage.

The collages were a useful extra to the probes and the interview. New issues that were not asked or mentioned before were revealed. These collages can be used as such to explain the characters and their way of life or even illustrating the feeling of future products. Also the marketing people were interested in using them as a resource.

BUILDING AN EMPATHIC DIALOGUE

Empathy with the participants

The informants must have a feeling of empathy and trust to provide subjective information. We met most of the participants personally before the study. The probes packages were accompanied with a letter explaining the aim of the study and the probes tasks with personal greetings. In response most of the diaries also ended with greetings.

The probes were returned to us prior the interviews for a first review which provided a starting point for a more reflective discussion. As we already knew about them and their life, and showed that we were interested in hearing more, the interviews were intensive and focused on personal issues and stories.

Supporting design empathy

"The design process needs to start with an understanding of the use situation" [7] In a process before the concept design the understanding can start with finding "the new eyes" to look at experiences [11]. We learned that it is not only the probes material that supports empathy but it grows during the process. In our case, as the designers of the client company were not involved in doing the study, it was important to build a dialogue with them to understand their interests and raise an expectation for the results. Their opinions were asked when designing the probes. When we got the probes back we invited the company representatives to read and look the materials to get feedback what kind of issues they found interesting to focus in the interview.

Figure 2. Probes and designers

The packages themselves with the interview produced visual and narrative data of the participants' world including what they do (photos), say (diary, interview) and make (ideal collages). [10]. Through the study each informant become vividly alive in attitudes, personality, motivations, and dreams. One company representative remarked as he was reading the original material, that the person could just as well have been right in front of him. The personal format and content of the diary complemented with the photographs was a powerful way of bringing the participant's way of life into the corporate meeting room.

DESIGNING THE MATERIAL FOR SHARING

How the material is to be communicated influences the choice and design of the probes. If needed the material should be designed in a way that it can be scanned and documented easily enough in its original format. When the probes are complemented with interviews or other methods, that data, e.g. photo album stories, should be easily combined with the probes.

With this type of user study, originality and credibility is the key quality in building empathy. Firstly, the probes kit materials are unique, handmade documents that communicate not only through the content, but also through handwriting, drawings, composition. The interviews are discussion about the materials, and there the most important qualities are the first person narration, language and vocabulary and then capturing all this and placing it in context with the original material. The same text handwritten and typed and printed out did not have the same empathic effect – the typed and printed matter was thought to be invented, not real.

The most preferred way for designers to have access to this kind of material is to put it on the wall or have it ready and available. If material is copied and distributed, the probes kit should be designed to support this and as much of the relevant originality should be retained.

CONCLUSIONS

Designers need both information and inspiration to be innovative, in that sense all the user data should not be cut up into small dry facts. [1] Analysing and digesting the empathic qualitative data into the design process needs time and effort, but at its best supports both communication, ideation and decision making. This way of doing user studies is also playful, flexible and easy to apply.

In this case the study provided empathic understanding of a segment of people. The personal stories and subjective descriptions supported a possibility of getting close to them and the originality was found to be an important factor in supporting credibility of the material. On the other hand the subjectivity brings another aspect: the data may be exaggerated or one sided.

The study was able to identify new perspectives for the client. After this study there are more defined questions to ask, situations and people to observe. In a concept design project the first challenge would have been achieved.

The opportunities of companies lie in the understanding of everyday life of people [13]. In this study an empathic user study approach was applied to document subjective user experiences in private contexts. The experience of the company was that they had received material to facilitate human centered design. The achieved empathy brought a new layer to their understanding of potential users and supported real product concept projects.

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How Young Can Our Design Partners Be?

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ABSTRACT
For this work-in-progress presentation, we report on our experiences working with young children as technology design partners. Our team from the Human-Computer Interaction Lab has extensive participatory design experience in working with 7-11 year old children. Here we describe our first year working with 4-6 year old children and the ways that we altered our methodologies to meet the unique needs of our younger design partners.

Keywords
Children, Participatory Design, Educational Applications.

CHILDREN AS TECHNOLOGY DESIGN PARTNERS

Over the past four years, the University of Maryland has been partnering with children as a way to understand what is needed to develop new technologies for children. This partnership has been heavily influenced by research practices over the past 25 years, including the cooperative design of Scandinavia (e.g., Bjerknes et al. 1987, Sundblad 1987, Greenbaum and Kyng 1991), the participatory design of the USA (e.g., Blomberg and Henderson 1990, Johnson et al. 1990, Greenbaum 1993, Schuler and Namioka 1993) and the consensus participation of England (e.g., Mumford and Henshall 1979). As Greenbaum and Kyng (1991) have explained, 'We see the need for users to become full partners in the cooperative system development process…Full participation of (users) requires training and active cooperation, not just token representation' (1991).

These approaches to co-design attempted to capture the complexity and somewhat 'messy' real-life world of the workplace. It was found that many times there were not sequential tasks accomplished by one person, but many tasks done in parallel and in collaboration with others. Interestingly enough, this description could also easily refer to the complexity and 'messiness' of a child's world. By the 1990s, these co-design practices were being adapted and applied to research with children (Druin 1997, Druin 1999, Druin et al. 2001, Druin In Press, Benford et al. 2000).

At the University of Maryland, twice a week, children ages 7-11, join researchers from computer science, education, psychology, art, and robotics to design new technologies together. Over the summer, the team meets for two intensive weeks, eight hours a day to continue our work. Children have remained with our team as long as four years and as short as one year. Together we pursue projects, write papers, and create new technologies. This intergenerational design team has produced research projects that include digital libraries for children (Druin et al. 2001), storytelling robots (Druin et al. 1999), and whole rooms that can be interactive storytelling experiences (Alborzi et al. 2000). Design partnerships with children have not been isolated to the University of Maryland. Children as co-designers became a critical part of the research methodology of a three-year project funded by the European Union's i3 Experimental School Environment initiatives (Benford et al. 2000, Taxen et al. 2001). KidStory was a collaboration between almost 100 children and 25 adult researchers in Sweden and England to develop new collaborative storytelling technologies for children. From 1998-2001, Researchers at the Swedish Institute of Computer Science, the Royal Institute of Technology, Sweden, and the University of Nottingham collaborated with the University of Maryland in generalizing design partnership methods with children.

Out of this research, numerous materials and methods have been developed that can support children and adults as they gather field data, initiate ideas, test, and develop new prototypes (Druin 1999). Team members use their unique skills and learn from each other throughout the process. We have found that no single technique is appropriate for all teams, so a combination of approaches has been developed that we now call "Cooperative Inquiry" (Druin 1999 and Druin In Press).

These techniques do not necessarily offer a magic formula for working with children, but rather a philosophy and approach to research that can be used to gather data, develop prototypes, and forge new research directions.

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THE CLASSROOM OF THE FUTURE

In the fall of 2001, we began a new technology design team with a kindergarten class (ages 4-6) at the Center for Young Children, a private preschool on the campus of the University of Maryland (See figures 1 and 2).

Figure 1. Working with our Kindergarten Design Partners

This team is part of a five-year project funded by the National Science Foundation that we call "The Classroom of the Future." The goals of the Classroom of the Future project fall into two categories: technological and educational. Therefore, we expect the outcomes of our research will include a better understanding of the input and output devices necessary for children to use technology, as well as methods to effectively design these technologies and use them in the classroom. Our team is developing new "embedded" technologies that can be a seamless part of any physical object in schools. We can expect that children's activity patterns will be supported by technologies that encourage active exploration, experimentation, and play. This is consistent with educational research that advocates the active construction of knowledge and skills for young children's learning environments (Eisner 1994, Department of Education 1995, Harel & Papert 1990, Papert 1980, Report to the President 1997, Ringstaff et al. 1993, Sandholtz et al. 1990, Vygotsky 1978).

Currently, we partner with two schools to develop technologies, which will be integrated into the classroom of the future. At the Center for Young Children (CYC), we are working with a kindergarten class of 23 children (ages 4-6) and two teachers. One teacher works with our group during most sessions. The teachers rotate so they can both participate in the design process. We also work with two kindergarten teachers at Yorktown Elementary School (YES), a public school in Maryland. Each YES teacher comes to the CYC once a month to take part in our design sessions. The kindergarten children and teachers at YES will evaluate and improve the designs of the technology, that we have built with the children at the CYC. Adult members of the team from the HCIL meet with both the CYC and the YES teachers every few months to discuss ways to continually improve our partnership.

Figure 2. The Center for Young Children, Where We Partner with Children and Teachers

A YEAR OF PARTNERSHIP

The first step we took towards partnering with young children was to help them understand that they can be inventors of technology who have ideas that matter in the process of creating new technologies. The first time we went to the kindergarten classroom our team spoke to the class as a whole. We introduced ourselves and explained that we design new technologies for kids such as robots and drawing games. The class was informed that we work with older children to make educational technologies and we now want to work with their kindergarten class to make technologies for younger children. Next, we initiated a series of activities designed to motivate the children to explore the design process, feel like inventors, and to help them become familiar with us as partners. Again this is consistent with the educational literature that suggests asking a child to actually "become" a scientist, artist, or inventor is an important component of a learning experience (Cooper & Brna 2000, Dewey 1902, Dewey 1936, Gardner 1983, Harel & Papert 1990, Shneiderman 1998).

During one of our first design sessions we worked with the class as a whole to design "computer mice of the future". The class was split into small groups. Each group was given a laptop with a computer mouse. The children used the mouse and observed each other using the mouse. They decided what they "liked" and "didn't like" about it. The children's likes and dislikes were dictated to the adults who wrote their comments on "sticky notes" (e.g. post-it notes). One idea was written on each note. These sticky notes were gathered together and grouped according to idea. Then, the whole team discussed the children's responses. We have seen that this process of invention can strengthen children's problem-solving skills (e.g., Fields 1987, Hill 1998, dson 1994, Lewis 2000, McCormick et al. 1994, Spoehr 1995).

At our next session the team again split into small groups. This time the children made pencil sketches of their ideas for the mouse of the future, in their notebooks. Adults helped the children annotate their drawings. The third time the group met, we split into teams and showed each other the sketches we made during the previous session. The groups decided what the best ideas were and collaboratively made three-dimensional sketches or low-tech prototypes of the mice of the future. The whole class gathered together and the children presented their low–tech prototypes to the rest of the group.

The team continued to use these methods to redesign a toy, a backpack, robots and more. In all cases, the children: (1) interacted with a technology, (2) watched others interact with technology, (3) decided what they liked and did not like about the technology, (4) sketched their ideas for a new version of that technology and then (5) combined their best ideas to create a model of their new technology.

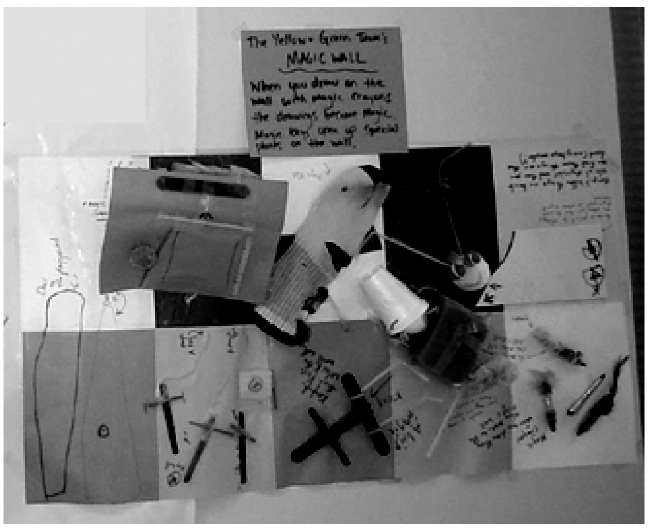
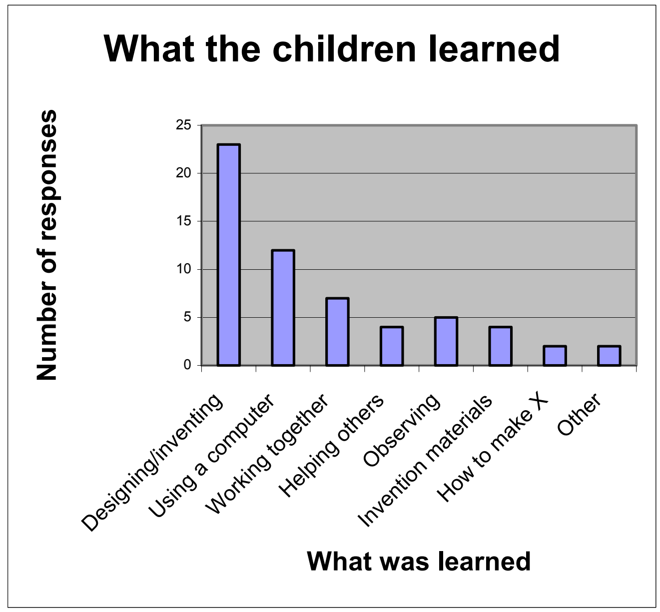


Figure 3. Low-Tech Prototype

After a year of partnership we asked the children to reflect on how they felt about being design partners. We asked 22 children to write in their journals. They answered the following two questions: What three things did you learn about being a design partner? and What two things were hard about being design partners? The children's responses are displayed as a chart in tables 1 and 2.

Most of the children felt that they had learned how to design. Many also thought that they had learned how to better use the computer or specific applications on the computer. This was not necessarily one of the goals of our research, but it was an unintended benefit.

The children found it difficult to work in groups. This is typical for children in this age group who are learning how to work and play with others. From an adult perspective it was often hard to get the children to listen to each other's ideas. However, the children did not appear to have arguments during the design sessions. The children reported that it was difficult to come up with ideas. We have found that this is a typical response of children in their first year of design partnership. The children also found it difficult to write. This is to be expected since most of the children that we worked with are not yet proficient readers or writers.



Tables 1. Children's Reflections

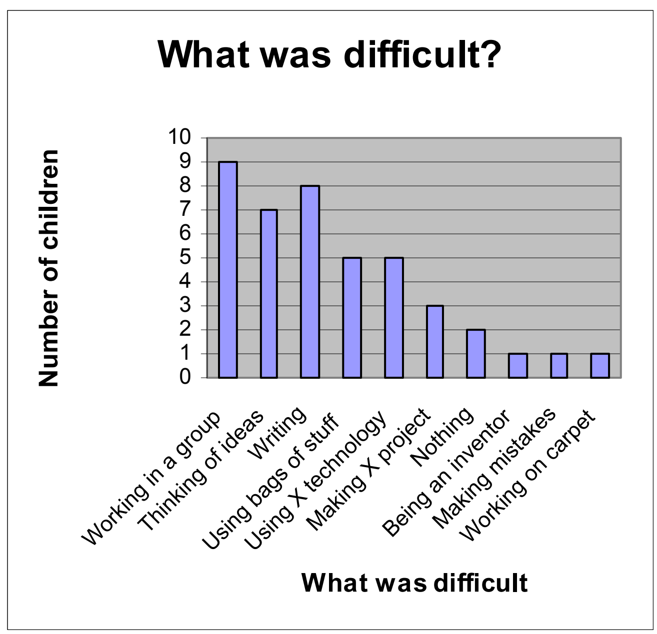


Table 2. Children's Reflections

NEW METHODS FOR WORKING WITH YOUNG CHILDREN AS DESIGN PARTNERS

Working with younger children has required our team to alter our design methods. We made eight changes to our methodology over the course of our six months with the children (See table 3 for a listing). These alterations were made after meeting with the CYC and YES teachers.

Changes to Design Methods
Amount of Writing
Less Sticky Note Reflections
Small Group Interaction with Adults
Fewer Whole Group Presentations
More Design Exploration
More Adult Facilitation
Bulletin Boards for Parents and Class Communication
Website for coordination with teachers

Table 3.

We knew before we went into the classroom that young children cannot write as well as the 7-11 year old children that we regularly work with. Therefore, we developed activities that would require less writing for the children. For example, the children we work with in our lab often write their thoughts or answer questions in their lab notebooks. Instead, our younger team members draw in their notebooks and adults annotate their entries.

The older children on our lab team typically write nine sticky notes when they are analyzing something. They write three things they like, three things they don't like and three more sticky notes on a third category. The third category varies based on project, but it is often "improvements". When we work with kindergarteners we typically ask them to make four to six sticky notes. They record two things they like, two things they don't like and occasionally two things about a third category. Since the majority of the young children we work with are not proficient writers, we ask them to draw pictures that illustrate their thoughts. Then the children dictate their likes, dislikes, etc. and the adults annotate the children's sketches.

When we began working with the kindergarten class, 23 children and eight adults were working in one room. When we split into groups and began designing, the atmosphere was noisy and chaotic. This made it difficult for the children to get one-on-one time with the adults in a way that is appropriate for "partnering" as opposed to "teaching". This situation was discussed at meetings with the teachers. Together we decided to take out one group of five or six children and work with them in a different room. The rest of the class stayed in the classroom. One teacher would come with the small group as long as there was enough teacher coverage in the classroom. Working with small groups outside of the classroom seemed to work better. The children appeared more focused and excited about their work with adults.

It has been well documented that it is challenging for young children to stay focused on certain tasks. In our experience we have found that the children we work with cannot sit still long enough for all the groups to present their ideas at one time. Therefore, we have one group present their ideas at the end of a design session. This structure enables each member of each team to present their ideas to an audience capable of listening to them.

Given that the children work in different groups we believe it is critical that the groups share their work with the rest of the class. Each child in a group is given the opportunity to explain their work, when their group gives a presentation. We ask children to present their work because it helps them clarify their ideas, recognize their accomplishments and improve their communication skills (Norton 1992). Also, the children are able to see what their classmates have done by simply looking at the bulletin board.

We have also found that young children need more opportunities to explore their ideas before building new prototypes. Therefore, we added an extra step in our design process. Whereas the older children in our lab team generally; observe and explore a technology, write sticky notes and then build low-tech prototypes. The kindergarten children; observe and explore a technology, write sticky notes, *sketch ideas in their notebooks*, and then build low-tech prototypes as a team. By adding this step to the design process we give children more ways to explore and refine their ideas.

We have also found that when we work with young children, the adult partners need to offer more ideas, start discussions, and propose more design suggestions. In general, the young children we work with have a harder time collaborating than do the children in our lab design group. In order to get input from all of the children we often have to pause a discussion to ask what a specific child thinks about a subject. Sometimes we have an adult sit next to a child who tends to interrupt or dominate the conversation. If this child feels that he has to speak, he can whisper his idea to the adult without disturbing the group discussion.

A *Classroom of the Future* bulletin board was set up to display the children's work. We did this to inform the children and parents about our activities. The purpose of this was to help children remember what they made, when they were between design sessions. This also brought their design work into the classroom, and hopefully initiated discussions. We have also found that our scheduled activities could not be planned very far in advance. The way one session went greatly affected what the team did during the following sessions. However, it was important for the teachers to know what could be planned in advance, so that they could plan their classroom activities appropriately. For this reason we set up an internal website. This website is easily editable by anyone, anywhere at anytime. Our team posted the schedule on this website and any member could change it at any point. We have found that the teachers check the website weekly to see what the group will be doing and how many children will be participating. The teachers from YES also check the website to get an update on the team at the CYC.

Continuing Work

Our next step is to adapt and develop the children's ideas into new interactive technologies accessible to 4-6 year old children. The goal of this portion of the research is to make something new for the classroom, find the best ways to integrate it into the classroom and enable the children to see their ideas realized.

To reach these goals, we conducted "inventor meetings". At these meetings children and inventors (adults who are not a part of the kindergarten design team) discuss design ideas. Together they are deciding what ideas will become high-tech prototypes. Some ideas the children have include: an advanced robotic pet that can dance, a "magic" wall and "magic" keys that can open special objects like a castle or a treasure chest.

Our current focus has been to build a "magic wall." With this technology, two children can hold "magic keys" in one hand, and finger paint simultaneously with the other. Children can draw stories that come to life with zoomable software our lab has been creating. The special hardware for this technology was developed with the support of the Mitsubishi Corporation.

We are currently using the magic wall with our partners at the CYC and observing how they use this new technology. Next year we plan to develop more applications for the magic wall and bring it in to other classrooms to see how they will use a technology designed by 4 to 6 year old children.

Conclusion

Through our research, we have found that in fact, young children can work together with adults and function as design partners. But, it is important to realize that 4-6 year old children have their own needs and opinions. Therefore, methods must be developed specifically for young children in order to successfully partner with them. We have found that if design methods are refined to meet the needs of young children, then new technologies can be developed in partnership.

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PD in Ponty: Design-by-Doing in Adult Basic Education

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ABSTRACT
This work-in-progress report gives a short account of the participatory design of ICT supported Adult Basic Education (ABE) courses in the South Wales Valleys region of the UK, a post-industrial area with low levels of educational attainment, widespread illiteracy and innumeracy in the adult population, and a growing digital divide. In the 1990s ABE provision in the region was expanded through the establishment of community-based Open Learning Centres (OLCs) dedicated to teaching adults basic literacy, communication and numeracy skills. The introduction of a network of personal computers with broadband Internet connectivity to one such center in 1997 led to the design and development of a number of innovative courses built around the use of new media technologies. Established practices in ABE supported the increasing participation of learners, tutors, and volunteers in this design process resulting in changes to the structure and content of ABE provision at the centre.

Keywords
Participatory design, adult basic education

Introduction: Empowerment and Organizational Change

All organizations encounter a variety of challenges as they grow. Conflicts and tensions at many levels within organizations both constrain and open up possibilities for the design of effective responses to those challenges. Often breakdowns in functioning reveal the underlying contradictions in an organization's activities, showing where change and improvement are required [13]. The process of designing solutions can itself become a source of conflict, often making new approaches possible only by questioning or challenging the status quo [3]. Such organizational disturbances involve mediating artifacts – physical and conceptual tools; rules, regulations, and cultural norms; the allocation of roles and responsibilities – that are themselves subject to a process of ongoing change and development. In order to identify new approaches that transcend the problems of the present situation, it is often the case that members of the organization as a whole must collectively move toward a shared understanding of the possibilities for novel action [11, 12].

The events described here took place within such a period of organizational growth. The setting is an educational center dedicated to helping adults improve their basic skills of communication, literacy and numeracy. Attempts to integrate the use of information and communication technologies (ICT) into well-established teaching practices revealed contradictions in the needs and motivations of managers, tutors, learners, and volunteers, while at the same time opening up a space where new approaches to the design of teaching and learning activities became possible. In this organization, technology seems to have acted as the "catalyst and occasion that expands the possibilities for organizational realignment and empowerment" [7]. In particular, possibilities for participating in course design, curriculum development and the shaping and use of resources became available to learners and volunteers, people with hitherto little influence on these matters.

A number of the courses discussed in this paper (those from 2000 onwards, see Fig.1 below) have been the subject of a longitudinal field study conducted by the researcher in the course of his doctoral research in human-computer interaction. To date this has involved more than 300 hours of participant observation, 38 interviews with course participants, and the collection of video and audio data. This paper is illustrated by stories told from the viewpoint of some of the participants. These "tales" are derived from the field study notes and transcripts, and are included by permission of the informants. In order to respect their privacy, fictitious names have been used.

The Background: ICT and ABE in England and Wales

The ability to read, write, and speak in the language of your nation of residence, and to use mathematics at a level necessary to function at work and in society in general constitute vital basic skills in modern societies. Currently, almost 8 million adults in England and Wales have

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difficulties with literacy and numeracy [1, 5], yet despite this level of need, over the past three decades Adult Basic Education (ABE) has been the "poor relative" within a chronically under funded education sector. Against this background the UK Basic Skills Agency (BSA) has been reluctant to recognize ICT based activities as being within the remit of basic skills education, wishing to avoid conflating controversial technology issues with a clearly focused campaign of lobbying for governmental funding and support. However, by the end of the 1990s, widespread recognition of the scale of basic skills deficits, debates about the desirability of developing an "information society" in the UK and a sea change in the funding climate following the election in 1997 of a new, socially-conscious Labour administration combined to bring a reversal of this stance. In common with the UK education sector as a whole, ABE is now enthusiastically embracing the possibilities of new technologies to attract and support learners, with the BSA investing in the development of online basic skills teaching and learning resources.

As a result of this history, it is only very recently that many ABE organizations have begun to address the challenge of integrating the use of ICT into their ABE teaching and learning activities. Consequently, there are few guidelines founded in practice for tutors to follow in their day-to-day teaching work, and a lack of suitable computer-based supporting materials. However, in those organizations where technology initiatives were pursued independently of the national policy, the absence of an official, centralized strategy has meant that managers, tutors, learners and volunteers have had an opportunity to participate together in exploring the use of ICT in ABE, developing new course structures and teaching and learning activities in the process. The "early adopters" involved in these ad hoc initiatives - conducted in isolation, and sometimes in the face of opposition from local administrators and technical support staff - now find that their fund of practical experience offers a valuable resource to the wider ABE community.

The Setting: Ponty OLC

The Open Learning Centre (OLC) is located in a converted shop premises in the heart of the busy market town of Pontypridd ("Ponty" to local residents), one of the principal towns of the South Wales Valleys. This post-industrial region of the UK has some of the worst social and economic deprivation in the European Union, with a GDP less than 75% of the EU average. Current assessments indicate that at least 40% of the local population have deficits in literacy and numeracy skills [6]. Research has consistently demonstrated clear associations between low basic skills and other indicators of socio-economic exclusion such as unemployment, criminality and ill health [15]. The links between education, income and technology access [16] also account for the digital divide clearly evident in the region, with Adult Basic Education learners among the very worst of the 'information poor'.

The OLC is housed in a bright, comfortable and well-maintained building, located within easy reach of public transport. It has three floors, with a well-equipped teaching and learning workshop on each level, each capable of accommodating up to 20 learners. The Centre is staffed by around 25 highly qualified and experienced ABE tutors, mostly employed on a part-time or job-share basis. Since opening in early 1997 the OLC has been an exemplar of innovative Basic Skills provision in Wales, winning several national awards and achieving high grades in education authority inspections.

The Manager's Tale

Mary, 52, is Head of School, meaning that she has overall responsibility for all of the basic skills provision in the area served by her college. Over the past two decades her efforts have been directed toward building up ABE from small, under budgeted beginnings to become a significant part of the college's mission. This has been a long and challenging struggle. Mary was instrumental in the introduction of ICT to the Pontypridd OLC in 1997, funding the original equipment purchases by winning an external award. This was a time when the national basic skills authority was not in favour of the use of technology in ABE, and she faced considerable opposition, both from within the college and from her peer group. Recognizing that the new possibilities offered by these technologies would require expertise from outside traditional ABE, she appointed new staff members to bring ICT skills and fresh viewpoints to the OLC. Since then, through staff appointments and resource allocation, she has strongly supported the participatory development of a student-centered, ICT-based learning strategy within the school. Mary is a strong, decisive manager, used to working within a clearly defined hierarchy, and has sometimes found the participatory process challenging. However, her own lack of training and experience in the use of ICT have led her to value others' contributions in this area, and she has encouraged tutors, learners and volunteers to develop their skills and offer their views, readily acknowledging their input and influence on her own ideas. Mary is now acting as an advisor on ABE to the newly devolved education funding authority in Wales, influencing the development of ABE at the national level.

Integrating ICT with ABE at the OLC: A Brief History

From the first attempt to integrate the use of ICT into an ABE course in late 1997, provision at the OLC has steadily increased and ICT supported courses now form a significant proportion of the overall curriculum. The range of activities involved has expanded from the use of Web browsers and email to include the creative use of digital video, multimedia, computer graphics, computer animation, desktop publishing and programming. From just one part-time tutor, one volunteer, and less than a dozen learners in 1997, ICT supported courses now involve a team of 6 part-time tutors, 2 full-time tutors and 8 volunteers working with around 60 learners each term. Between them, the team delivers more than 24 teaching hours a week. In addition, many of the more traditional literacy, numeracy and communication classes at the OLC are also beginning to draw on team expertise to incorporate some elements of ICT use into their activities wherever appropriate.

Figure 1 summarizes the growth in provision of ICT supported ABE courses at the OLC in the period 1997-2002.

Figure 1: ICT-based ABE courses at the OLC 1997-2002

	Course	Activities
1997-98 4 hrs/week	Internet Club	Web browsing & searching Email HTML authoring
1998-99 6 hrs/week	Internet Club 2	Web browsing & searching Email HTML authoring Computer graphics Navigating 3D virtual worlds
1999-2000 8 hrs/week	Netwise Internet Club 3	Web browsing & searching Email HTML authoring Computer graphics Navigating 3D virtual worlds
2000-01 16 hrs/week	Computer Creative Web Workshop Computer Club	Web browsing & searching Email HTML authoring Computer graphics Computer animation Digital video Computer Programming
2001-02 24 hrs/week	Computers Count Film Workshop DTP Workshop Web Workshop Computer Club	Web browsing & searching Email HTML authoring Computer graphics Computer animation Digital video Computer Programming Desk-Top Publishing

The Tutor's Tale

Simon, 44, is a graduate in computer science. He began work at the OLC as a part-time tutor in 1997, commissioned with developing ICT-related courses. His initial brief was to run two weekly sessions using the Internet, developing communication, literacy and numeracy skills through the use of email and the World Wide Web. With little published material or best practice in the field to draw on, Simon adopted a pragmatic and exploratory approach to course design. Having been introduced to participatory design while studying human-computer interaction, Simon encouraged the active participation of volunteers and learners in course development, mainly through group discussions. This proved very successful, with many of the ideas put forward being incorporated into the design of those early courses. During the following year, Simon helped to set up more formal focus groups that involved tutors, learners, volunteers and managers in the design and development of new courses and accreditation structures. In the academic year 2000-01 Simon was the facilitator for Computer Creative, a yearlong, student-centered, project-based ABE course that used new media technologies to develop basic skills. This was organized in response to requests from learners, and fully embodied the design-by-doing approach developed in previous courses. Its success has influenced the design of a further 4 courses at the OLC in the current academic year, and Simon is now working on extending participatory design approaches to other aspects of curriculum development.

Developing Participation: Design-by-Doing in ABE

ABE in the UK has a strong tradition of individual empowerment through learning and has long recognized that best practice should seek to place course activities in the context of learners' everyday lives. This means that most traditional ABE courses already incorporate significant scope for tailoring to the individual requirements of students. Literacy and numeracy are developed through the completion of real and relevant tasks such as dealing with household bills or making job applications. This student-centered approach has also led tutors to become skilled in mapping diverse and often informal activities to the more rigid requirements of ABE organizations' formal accreditation and reporting structures.

One means through which this mapping takes place is the Individual Learning Programme (ILP), a paper-based document that records a learner's needs, long-term aims, and achievements during his or her time in adult basic education. The ILP is an ongoing and collaborative production by learner and tutor that begins with their initial meeting. It also constitutes a log of the learner's activities and achievements that is updated at the end of each teaching session. At six-weekly intervals learner and tutor meet to formally discuss progress toward the long-term aims set out in the document, and to agree on new goals for the next six-week period. Wherever possible it is the learners themselves who inscribe the ILP entries, a valuable exercise in literacy and empowerment. They are encouraged by tutors to see the ILP as a living document, in their ownership, that complements the portfolio of work they build up for each course they take part in. At the OLC the ILP is a boundary object [17] that serves to communicate and coordinate the various perspectives of learners, tutors, volunteers, and managers. Often learners will be assisted by volunteers in keeping their ILPs up to date, and occasionally managers will use ILPs as a basis for monitoring and discussion.

At the OLC, this pattern of close and regular consultation between learners, volunteers and tutors around a mediating artifact provided the basis from which the greater participation of learners in the design of their course aims, objectives and activities could develop. The friendly, informal and largely non-hierarchical nature of the setting and activities fostered impromptu group discussions and the formation of ad hoc focus groups around issues of interest such as what topics should be covered by a course, or what would be the best design for a website hosting online learning resources.

Another factor in the development of participation in design at the OLC was continuity. The structure of ABE, in recognition of the challenges adult basic skills learners face, allows them to remain in education, moving on from one course to the next, for as long as they continue to have identifiable learning needs. For their part, staff and volunteers tend to feel a strong sense of vocation and have an ongoing commitment to the team in which they participate. Thus, some tutors, volunteers and learners have been involved with the participatory development process at the OLC since it began, and continue to play an active role. The co-constructed artifacts [2] – websites, lesson plans, learning activities, multimedia presentations, etc. - that they have created together constitute a shared history of success and provide the basis for future activities.

Figure 2 shows trends in participation in course design by learners, volunteers and part-time and full-time tutors over the years 1997-2002. The measure "degree of participation" represents time spent on activities directly related to the design of course content and structure as a proportion of the total course hours. Initially, learner input to design was relatively low, but steadily increased as the explicit use of PD techniques became established, reaching a peak with the highly participatory design of the Computer Creative course in 2000-01. The contribution of part-time tutors to course design was much greater than is the case in non ICT-based courses, and at the inception of the courses can be seen as the major input, decreasing in importance as learner involvement grows. Prior to the introduction of ICT, volunteer contributions to course design were virtually nonexistent, but Figure 2 illustrates how volunteer involvement in design activities was significant, especially in the early, pioneering courses. Since 2000-01 the degree of participation of learners and tutors remains significant, but is currently lower as a proportion as more full-time tutors have joined the team, and ICT-based courses begin to make use of outlines established as a result of earlier PD activities.

Figure 3 summarizes PD techniques used in designing course structure, content and activities at the OLC, and lists some of the artifacts that were significant mediators of the participatory design process. Much of the direct design activity can be described as "design-by-doing" [9, 10] through cooperative prototyping [4], where tutors, volunteers and learners worked together at the computer to create teaching and learning resources directly on the network. In the closing stages of the 1999-2000 courses staff organized a number of future workshops in which learners and volunteers envisioned aspects of the design of the 2000-01 ICT-based curriculum.

Figure 2: Participation in design

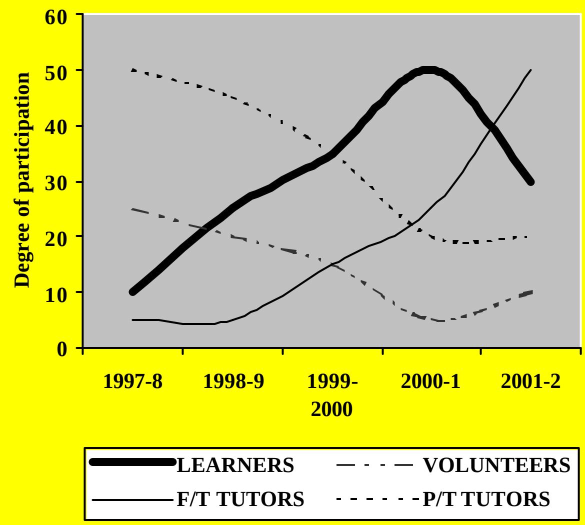

Figure 3: PD techniques and mediating artifacts		
	PD techniques	**Mediating Artifacts**
1997-98	Focus groups Cooperative prototyping	Intranet/Course Web site Personal Web sites Local Area Network Individual Learning Programmes
1998-99	Focus groups Cooperative prototyping	Intranet/Course Web sites Personal Web sites Local Area Network Online 3D virtual worlds Individual Learning Programmes
1999-2000	Focus groups Cooperative prototyping Scenarios Future Workshops	Course Web site Personal Web sites Online 3D virtual worlds Individual Learning Programmes
2000-01	Focus groups Cooperative	Course publicity materials Multimedia applications

	prototyping	Digital video Computer programs Models & puppets Workshop activities Individual Learning Programmes
2001-02	Focus groups Cooperative prototyping	Course publicity materials Multimedia applications Digital video Computer programs Models & puppets Workshop activities Individual Learning Programmes

The Volunteer's Tale

Ceri, 27, initially attended the OLC as a learner in an entry-level literacy class. At school, he had been very interested in technology and computing, but his lack of reading and writing skills meant that he left without any formal qualifications. Since then he had been unemployed or in casual work. Much of his time was spent at home, tinkering with cast-off games consoles and computer hardware. Ceri worked hard in class at the OLC, steadily improving his communication skills and gaining credits in literacy and numeracy. He showed keen interest in all ICT-related activities, and became a volunteer teaching assistant, providing one-on-one support for learners. In time he established himself as a primary source of technical expertise and computer maintenance at the OLC, a role that was essential to the continuation of some courses. Over the next 3 years, Ceri's input to the development of course content and structure was significant. He suggested topics and approaches that were developed into lesson plans; took part in focus group discussions with learners, tutors and managers; developed interactive course materials; found and installed useful freeware and shareware software that supported new activities; and suggested and pioneered the use of online 3D virtual worlds. His involvement as a volunteer, technician, and in the focus group discussions brought him into contact with the Head of School, who recommended him for a part-time technician's post with the college. He is now in full-time employment and continuing his education in evening classes.

Discussion

This account has outlined how circumstances at the OLC combined to provide many of the ingredients needed for participation in the design process [8]. The lack of a clear central policy, little in the way of experience or established best practice to draw upon, and the student-centered tradition in ABE brought about a situation of organizational flexibility. A lack of external technical support meant that available development resources – the network, applications – were under the direct control of the users. Practices already in place in the organization, the presence of suitable mediating artifacts such as the ILP, and the interactive nature of the technologies involved supported focus groups, cooperative prototyping and future workshops as appropriate development methods. Through the medium of the broadband Internet connection, participants were able to access information relevant to the activities in hand.

At the OLC, the introduction of ICT acted as a catalyst for innovation in both course design and organizational structure. People who, prior to these new opportunities and needs, would have had very limited opportunities for participating in course design, curriculum development and the shaping and use of resources, were empowered to contribute their individual skills, knowledge, ideas and enthusiasm to collaborative activities - creating websites, configuring the network, drawing up lesson plans and so on – that were significant in shaping activity at the Centre. In the unfolding of this process the value of PD techniques have become clearer to participants, and have been increasingly emphasized. However, as in many PD projects, questions of sustainability remain unanswered [14]. In a period of continuing growth and ongoing organizational realignment, the continuance of PD activities in Ponty will depend on the sustained commitment and support of key individuals.

The Learner's Tale

Sarah, 38, has been attending literacy and numeracy classes at the OLC since it opened in early 1997. Her initial assessment found that she was functionally illiterate and innumerate with additional learning and behavioural difficulties. In class she was very withdrawn, often refusing to engage in activities and speaking very little. She did, however, show an interest in ICT, and joined the Internet Club course in September 1997. She was particularly drawn to computer graphics activities, and showed great flair for this work. As she grew more comfortable with the setting she became more communicative, and was soon making an essential and very vocal contribution to group discussions. The next year, suggestions by Sarah and other learners were embodied in the course structure. Sarah's motivation strengthened, she began to gain qualifications, and showed very marked improvement in her communication, literacy and numeracy skills. Sometimes she acted as a mentor to other learners. She went on to become a key member of focus groups and future workshops, participating in the design of course structure and content. Sarah is now becoming an accomplished computer graphics artist. She continues to improve her basic skills at the OLC while undertaking small private commissions, creating greetings cards and brochures for clients.

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Projeto Crisálida (Chrysalis Project) : participatory interdisciplinary educational proposal for intervention in the female prison system of southern Brazil.

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ABSTRACT

This article describes an interdisciplinary research project for intervention in the rehabilitation of women inmates in Brazil. The study proposes an educational program in the use of digital technologies as a pathway for women inmates to find meaningful work and rejoin society. The use of technology is seen as a factor that minimizes social exclusion through the development of an educational program of technological teaching and of preparation for work. The program generates a proposal inspired by Activity Theory and Participatory Design. The project includes the construction of a software specific for the prison clientele, according to a methodology based on a participatory approach and gender focus.

Keywords

Education, technological literacy, interdisciplinary, software, gender, activity, participatory design,

INTRODUCTION

This article presents an interdisciplinary research proposal called *Projeto Crisálida*), directed towards the development and application of social technology. The study presented here refers specifically to an educational intervention in the rehabilitation system of the Female Presidium in the city of Florianópolis in Brazil and has generated two doctorate studies currently in progress.

The research named *Projeto Crisálida* is composed by two studies proposed and constructed in an interdisciplinary perspective. The project has both a pedagogical strand and, a software development strand. They are:

- *Study I* is an educational initiative for the creation and development of a pedagogical program of digital literacy that seeks to increase inmates' opportunities for employment when they leave jail.
- *Study II* aims to build, to develop and to apply a computational technology for the development of a prototype of educational software, centered on the user, following insights of gender.

GENERAL OBJECTIVE

Creation of a program of technological literacy following social constructivist learning approaches and construction of a software according to insights of HCI as an attempt to minimize inmates' social exclusion.

SPECIFIC OBJECTIVES

The interdisciplinary nature of *Projeto Crisálida* distinguishes objectives that are related to the three main focuses shared by the two studies mentioned:

- **Digital Literacy Program**

To build a digital literacy program as a mediating tool to social exclusion that culminates in opportunities for continued education, work in jail, and employment after incarceration.

To analyze the processes of computer tools appropriation observable during the development of the Digital Literacy Program that has been developed in a Movable Computing Lab.

- **Construction of Tools**

To develop an educational software having as basic characteristics collaborative learning, participatory control and security strategies for use that is appropriate to the context of the target clientele.

To include insights about the influence of gender in the process of developing interfaces for softwares from the angle of the feminine public.

To create a model of ideological policy for the use of the Internet in environments where security and control of traffic information are strategic, e.g. for application in educational programs in a prison.

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- **Perspectives in the Gender Approach**

Following a pedagogical strand (the Digital Literacy Program), gender is seen in the perspective of improving women's position and equity without radically altering the existing structure of gender relations. From this point of view, a woman is empowered when she is literate, educated has productive skills, aware of the need of developing computer skills. Self-confidence, access to work, autonomy and citizenship would be possible outcomes of women's empowerment.

According to a technological strand (software) a gender perspective is raised based on neurological research [13] that refers to differences in women's appropriation of tools when compared to men and HCI insights about the empowerment of women through the Internet [2].

The aim of this study is to underline and include women's characteristics in the process of developing a guideline as an orienting device to be applied in the creation of specific projects to be designed for women, e.g. educational programs, e-commerce directed to women, creation of shells to personalize software interfaces (color, metaphors, functional preferences, etc.).

PROFILE OF THE TARGET CLIENTELE

UNESCO [15] makes specific reports available on the profile of the female prison system in Latin America from a perspective of basic education and gender. The aspects referring to our country, Brazil, are sparsely cited in the reports. In the USA there are documents that show the American prison universe clearly and extensively, but the American reality cannot serve as a model for the study of Brazilian reality for multiple contextual reasons. The reality of each country has its own peculiarities, for example, in Latin America the aspects that generate exclusion are similar (poverty and illiteracy), but the political and social conditions are different.

The information available regarding the Brazilian prison context is usually the result of institutional research that reports on conditions in Brazilian prisons from a human rights perspective. In this kind of research the female prison universe is usually confused with the male universe – the questions of gender and the specific characteristics of each segment are not revealed completely in the majority of the reports on the research. Individual difficulties in the context of the Brazilian prison system are revealed in many different ways. For example, the level of schooling of the prison population is generally low. The Research of the Latin American Institute of the United Nations – ILANUD 2000 [7] indicates that 44% of the prison population had no defined profession prior to their imprisonment and 42% were unemployed and made functionally literate (60% of the inmates did not complete elementary school). The existence of intellectual emptiness is evident – it is not enough to teach prison inmates to read and write.

Such factors contribute to the lack of opportunities and the ability to compete in the labor market. Unemployment, lack of professional preparation, the nonexistence of life projects and the impossibility of providing for him/herself, are some of the main roads that lead to criminality.

Work usually keeps the prisoners away from criminal organizations, and education that aims at the preparation for work is a factor of extreme relevance for their social reintegration. It is necessary to stress variants, concerning the psychosocial aspects and those of a judicial nature, that directly influence the quality of actions that are conducive to prison rehabilitation and the institutional conditions of the Brazilian prison system.

In spite of many financial, social and political problems in designing programs of adult education for prison inmates, there are relevant proposals being held in our country. Most of them are concerned with education literacy. Technological literacy programs are sparsely offered to women inmates in the Brazilian prison system. Aiming to equate gender issues in technology design and social exclusion we decided to invite, as participants of the research, a group of women inmates incarcerated in the presidium of the State of Santa Catarina located in Florianópolis City, Brazil.

Profile of Subjects of Interdisciplinary Study

The 40 inmates of the Female Presidium of Florianópolis, from 20 to 40 years of age, constitute the subjects of this research. According to the report of the Department of Penitentiary Administration of Santa Catarina, 5% of those convicted were sentenced to over 20 years of prison. Drug dealing is the infraction that leads most of them to imprisonment. They have an average of three children, 35% are HIV carriers, 5% are illiterate, 85% completed elementary school. Only 5% of these prisoners have a defined profession; 85% of these clientele participate in the opportunity for work offered by the prison system (making paper bags and assembling leather balls).

JUSTIFICATION

The educational programs in the system of prison rehabilitation are of primary importance for the reconstruction of the autonomy and social identity of the individual, for gaining economic independence, for exercising freedom in a perspective of citizenship and guaranteeing the exercise of human rights.

The opportunity to prepare for the exercise of a profession and to acquire abilities that guarantee a place in the world of labor, are factors that can assure the recuperation of self-esteem, the creation of individual life projects, and the minimization of new crimes and consequently, a better situation of public security. However, there are difficulties in relation to institutional questions that are related to the reality of the educational, political, economic and social context of the target clientele of this project, such as: a) the fragmentation of actions of rehabilitation that do not link elementary teaching programs to work preparation programs; b) the scarcity of preliminary studies of the prison community, to verify the needs, interests and expectations involved in a participatory approach; c) the absence of educational programs that seek to offer digital inclusion[1] as one of the possible ways to generate income through work, autonomy and minimization of the situation of stigma that affects every ex-prison inmate; d) the extremely small number of job offers to those who leave the prison system due to their lack of professional preparation and to prejudice on the part of society as a whole; e) isolated rehabilitation activities, generally through volunteer actions, without establishing attainable post-prison goals; and f) that building educational programs directed towards digital technology according to a participatory design approach is practically nonexistent in the rehabilitation programs integrated with the prison rehabilitation system in the female presidiums in the state of Santa Catarina, Brazil.

METHODOLOGY

Research is applied according to an action research approach [14] to elaborate the diagnosis and construct the educational project of technological literacy. It has its support in theories of development within cognitive science [10], in concepts elaborated by Activity Theory [1, 4], and it is inspired by a pedagogical line of social interaction [16].

The theoretical lines mentioned above are within the scope of the Digital Literacy Program proposed in this project First, theorists within the cognitive science field propose that thinking involves the manipulation of internal representations of the external world also identified as mental models. The strategic model of reading proposed in the program is based on this theory. Next, the influence of Vygotsky's principles [16] are relevant to the study, for example connections between development and learning processes, focus upon the role of the individual in his/her social-historic-cultural context, and clarification of the concept of mediation. Finally, activity theory research proposes a structure for analysis of human practice based on the concept of activity in a systemic view, e. g. this study refers to a systemic universe that just may be altered by mediation and transformation - the prison system.

HCI techniques [11] and the application of methods of participatory design [8, 9] are crucial in the process essentially centered on the user for the development of the educational software. This work includes orientation and development of gender insights, in a perspective of power relations [5] and of construction of autonomy [2, 5, 6], in the process of building the educational program and the creation of the educational software as well.

[1] *Digital inclusion* means to offer educational conditions to poor, socially excluded people to overcome digital illiteracy, and lack of work opportunities and access to information by means of computational tools.

DEVELOPMENT

The *Projeto Crisálida* is identified as a technological literacy program and includes a) the educational intervention program in the female presidium of the city of Florianópolis, State of Santa Catarina, Brazil, known as the *Digital Literacy Program* and b) a computational tool designed following concepts of usability, named the *Educational Software Tool*. Each stage of development of the project was determined from an interdisciplinary and global view of the educational process.

A) Digital Literacy Program Stages

1. Creating Digital Resource Environment - sought to create an environment for the tools available for the phase of digital literacy (digital camera, computer, printer and text processor) developed in a *Movable Computing Lab*.

2. Development of Participatory Project - included the initial practices for the construction of the project in the form of a *Communication Digital Workshop* with the cooperation of participants, in order to define the aims, methods of development and selection of the product to be generated.

3. Communication Workshop - presented reading of texts with general information, guided by a problem-solving approach, from the instrumental viewpoint, with the aim of following some instructional parameters of the activities proposed, reeducating women inmates and including them in uses of digital technology such as: a) providing, in a short space of time, strategies to facilitate reading, which contribute to the minimization of text comprehension problems; b) achieving the goal of constructing a product via digital technology; c) stimulating the development of useful and applicable abilities for their future professional lives; d) generating an environment of cooperation and work to develop the final product; and e) evaluating the process by means of a homepage proposal (under construction) and individual interviews.

B) Educational Software Tool Stages

1. Movable Computing Lab Support. A bus was adapted as a movable laboratory of computing. A printer and 12 computers were installed inside the bus. The idea was to introduce computational skills through the tasks proposed in the Communication Workshop. This stage was designed to capture the women's needs, style and desires when they faced the situation of being introduced to computing skills.

2. Development of the Participatory Design. Literature does not highlight gender issues as a factor to affect technology design. This research was inspired by participatory design methods. Practice was proposed and developed as a way to promote cooperative production between inmates' experiences and abilities and the designer's aim to evaluate usability based on gender issues.

This way, three main steps were followed: a) a needs analysis and analysis of the possibilities to undertake the project; b) evaluation and selection of technological components; and c) inmates' participation in the software design by means of interviews, questionnaires and productive evaluation.

3. Software Construction is currently in progress. After experiencing the digital workshop and analyzing the circumstances of need, context and principles of use, the software construction was devised. The software design follows some principles such as: a) personalizing its characteristics as much as possible, so that it becomes, at the same time, the initial tool for learning how to use the computer and a useful production tool; b) using computer networks to allow for cooperative work as in CSCW design [3]; c) creating an ideological policy for the prison system to access the Internet based on principles of access that do not discourage the user; and d) generating an access coordination provided in a system with specific functions for the administrator of the system, tutors and users and in intelligent software agents to control the security, e.g., search agents, security access agents and content agents.

Commentary

It is important to emphasize that the objectives of this project were delineated with the participation of the community involved. The diagnosis resulted from direct contact with the subjects, through a survey of the needs of the social segment of the excluded. Questionnaires, Interviews, video and audio recording are used as instruments of research. The product to be developed in the workshops and the generating themes were selected collectively and cooperatively.

Needs analysis research shows that financial autonomy that may enable inmates to support the family was one of the most pressing needs. Among other aspects, basic education was seen as necessary; however, a short-term activity to support the family was identified as the highest priority.

Because this research is still in progress, there are issues yet to be accomplished, for example conducting the Work Practice Workshop and creating the educational software.

For the development of the final stages, voluntary participation is expected from the women who participated in the previous stages, to take part in the construction and validation of the software and the educational program proposed.

PERSPECTIVES

It is hoped that this project will stimulate the creation of pedagogical methods (models) applied to educational programs with a social focus that utilizes new technological devices.

Human-computer interaction research is expected to generate subsidies to evaluate the impact of digital technology on the preparation of adults for the work world and their adaptation to the labor market, including women in incarceration. The chief aim is to promote social development through education and digital inclusion.

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Increasing the Participation of Indigenous Australians in the Information Technology Industries

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ABSTRACT
Indigenous Australian people continue to experience chronic disadvantage relative to the living standards and well-being of non-Indigenous Australians. Despite the increased availability of education to Aboriginal Australians, their participation in Information Technology programmes is very low, as is their awareness of the options available in the Information and Communications industries. In this paper we report our findings and recommendations from a project designed to investigate how to increase the participation of Indigenous Australians in Information Technology courses. We sought out existing examples of successful Indigenous education initiatives and considered how appropriately situated variations could be developed within an Information Technology Faculty. We have learned that successful initiatives to improve the lives of Indigenous Australians depend on the active participation of Indigenous people. The insights from Participatory Design practices, including the tools and techniques for involving participants in the design process, whatever is being designed, will continue to inform the evolution of this project.

Keywords
Access and equity issues, Indigenous participation, Education and training, ethics and social justice

INTRODUCTION

Very few Indigenous Australian students are enrolled in Information and Communications Technology (ICT) courses or are working in the ICT industry. Out of the 8,000 Indigenous students participating in tertiary studies in Australia, during 2000, only 107 are enrolled in computer science programmes [6]. Most of these students are studying at technical institutes with very few enrolments in universities.

The University of Technology, Sydney (UTS) has made a major commitment to the process of Reconciliation between Indigenous and non-Indigenous Australians. It was among the earliest Australian institutions to make a formal commitment to the Reconciliation process, committing to the *UTS Reconciliation Statement* in 1999 [8]. This statement recognises the centrality of education to the Reconciliation process and commits the university to ‘ensuring that Indigenous participation in the higher education system is increased across all levels and all areas’. The project reported here is an investigative project, initiated by the Faculty of Information Technology (IT) and designed to find ways to increase the participation of Indigenous students in the Faculty’s courses.

We report on the project here for a number of reasons. However, there are two particular points of relevance for the Participatory Design Community. The first is that there is a long history of initiatives aimed to improve different aspects of the lives of Indigenous Australians that have failed miserably, often at enormous cost to Indigenous people. A major reason for this failure, now widely acknowledged, is that there has been little participation of Indigenous people in the design and implementation of policies and processes that directly affect them. Successful policies and processes are notable for their participatory commitments where Indigenous people define their own problems and their own solutions to them. Historically, it is clear that the integration of information and communications technologies into Indigenous communities and enterprises will benefit from the use of Participatory Design techniques and approaches.

The second point of relevance is that, at the present time, the participation of Indigenous people in any kind of relationship involving those who design ICT and those who

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use it will be constrained by the scarcity of Indigenous IT professionals. Users may increasingly be Indigenous Australians, but designers will, almost always, be non-Indigenous. This current project, therefore, is situated in some prior historical space to traditional Participatory Design projects, but we are relying on the insights from the field to shape how we proceed. It is a project aimed at the participatory design of access and participation of Indigenous Australians in IT. This report includes some discussion of the background and scope of the project, our findings to date and our plans for future work.

SOME BACKGROUND

Indigenous Australian people continue to experience chronic disadvantage relative to the living standards and well-being of non-Indigenous Australians. Over the last twenty years education has been increasingly accessible to Aboriginal Australians and has been a key initiative in reversing disadvantage. Higher education has also played an important role in providing education and training that is responsive to Indigenous community needs and aspirations. This has been achieved through the provision of culturally appropriate support and academic assistance and the development of academic programmes that are inclusive of Indigenous Australian perspectives and needs. However, continuing educational inequalities prevail.

The experience of Indigenous people in education is very different to that of non-Indigenous people. Non-Indigenous students are much more likely to have completed secondary education, while Indigenous students are more likely to have no formal qualifications at all. Indigenous students are much more likely to be admitted to higher education on the basis of special entry schemes or institutional assessments and less likely to be admitted on the basis of past higher education or school education. The lack of pre-requisite knowledge needed for success in university has been identified as a key factor affecting the performance of Indigenous people in higher education {2].

Moreover, after nine years of steady growth, the number of Indigenous students at Australian Universities is dropping. In 2000 there was a drop of fifteen percent in the number of commencing students [7]. The decrease in numbers effected full and part-time students, internal and external students, all age groups, all levels of study and all fields of study, except agriculture and architecture that had only 10 students nationally when the data was compiled [3]. There is no category in this report for students in IT programmes. Changes in the criteria for financial support for Indigenous students, introduced in 2000, are blamed for the decline in commencements that year. But enrolments have been slowing since 1997, coupled with declining rates of success and participation in school education. Anecdotal evidence suggests that there may be other factors in this decline, including early disengagement by Indigenous high school students. Yet there is a significant increase in the numbers of Indigenous people of school and university age; 40 percent of Indigenous people are under the age of 15 compared with 20 percent of non-Indigenous Australians.

Many Australian universities have a department or centre that is dedicated to attracting and supporting Indigenous students. Jumbunna was launched as the *Indigenous House of Learning* (IHL) at UTS in 2001. It has grown from an Aboriginal student support centre, first established in 1986, to become one of the most successful academic, research and support centres in the country with approximately 350 Indigenous Australian under-graduate and post-graduate students studying throughout UTS.

Indigenous support units were developed in recognition of the importance of education in bringing about self-determination for Indigenous peoples and to counter prevailing cycles of poverty, including contributing factors such as unemployment, health and welfare dependency. Past government policies of exclusion from accessing education and inappropriate and sub-standard education provision as well as many other interrelated issues have created cross-generational poor educational experiences. These include broken and / or limited attainment of formal education. Educational outcomes at the school level have been slow to improve and to accommodate Indigenous learning perspectives and experiences.

While UTS now has a number of well-established and successful programmes to promote the participation of Indigenous students in higher education, these programmes have, to date, focused on areas of immediate need to Aboriginal communities such as law, education and nursing. There is a clear need, both in response to changing demographics in the Aboriginal community and for reasons of ethics and social justice, to expand and facilitate access and participation of Aboriginal people across all academic disciplines and to encourage increased Indigenous participation in the full range of professional training available to other Australians.

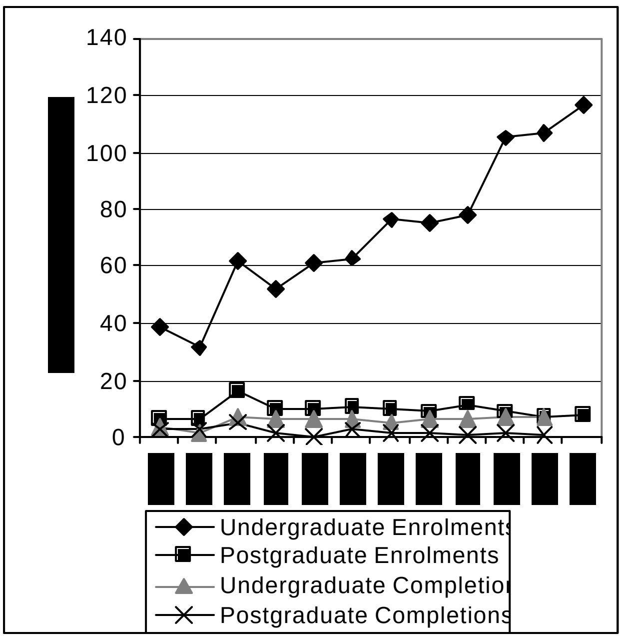
In September 2001, during the development time for this project, the Federal Department of Immigration and Multicultural Affairs (DIMA), the Aboriginal and Torres Straight Islander Commission (ATSIC) and the Australian Information Industry Association (AIIA) announced a joint initiative to increase the participation of Indigenous Australians in the ICT industry. The initiative involves programmes and strategies to improve education, employment and business development outcomes for Indigenous Australians [4]. At the launch of the initiative, Geoff Clark, Chairman of ATSIC, noted that the tiny number of Indigenous students already in IT courses carry a great responsibility:

> They are pathfinders, but they carry a double burden. They are role models for their communities but they

> also need to break through barriers to the employment of Indigenous people in IT industries. Their efforts will lay the foundations for future careers. It is our task to ensure these young people - and their younger brothers and sisters inspired by them, have the freedom to choose careers in the IT sector. It is up to us to ensure that they are not unfairly excluded from their choice of career because of institutionalised poverty, racism or denial of culture [1].

Despite a growing commitment from parts of the ICT industry to social responsibility issues, particularly the needs of Indigenous Australians, despite a growing number of organisations providing cadetships for Indigenous trainees and despite a genuine interest and commitment from the Faculty of IT to increase the participation of Indigenous students in our programmes few Indigenous people are entering IT programmes either here or elsewhere. Moreover, as shown in Figure 1. (below) those who do are not completing their courses. The unacceptable completion figures indicated in Figure 1. are another confirmation of the prevailing wisdom that Indigenous students are most successful when they are in learning environments that are culturally affirming and incorporate Indigenous perspectives. These figures also demonstrate the need for programmes that both attract students to IT courses and then, most importantly, provide the support required to enable these students to complete their courses.

Figure 1. Indigenous Students in Australian IT Programmes (Source DEST, Higher Education Student Statistics, 1989-2000)



So we are at a time when overall Indigenous participation in higher education is declining, when rates of success and completion in secondary schools are declining and when economic support for Indigenous students has been made less accessible. It is also a time when the local ICT industry is seeking greater participation of Indigenous people starting from a participation rate so low that it has not been measured. But it is also a time when increasing numbers of both Indigenous and non-Indigenous Australians are recognising the centrality of the Reconciliation process to the national interest and seeking ways to drive the process forward. This research project is one such initiative.

The main aims of the project were to identify the relevant issues we need to understand and to provide a thorough and well-grounded understanding of them. This understanding will guide initiatives to increase Indigenous student participation in IT programmes while continuing to build a stronger relationship between the IT Faculty and Jumbunna IHL. Within this context, there were a number of strands defined to guide the initial research project so that it could contribute to the information requirements of both the Faculty of IT and Jumbunna Indigenous House of Learning. The strands were to:

- research existing feeder programmes, supplementary programmes and other related programmes, designed to increase the participation of Indigenous students and other disadvantaged groups, run by other faculties within UTS, by other universities and by other agencies. The objectives of this strand of research are to establish the strengths and weaknesses of existing programmes, to investigate how successful programmes have been tailored to specific disciplines and to identify relevant implications for IT at UTS;
- research IT, as a discipline, with the aim of articulating the different levels, areas and aspects of the discipline that need to be considered when developing programmes to increase the participation of Indigenous students;
- work closely with Jumbunna IHL to build and develop relations between Jumbunna and the IT faculty and to ensure that this research is consistent with, and furthers, the aims and objectives of Jumbunna;
- develop a range of options, strategies and recommendations for the Faculty of IT to increase the participation of Indigenous students in the IT industry.

Over 40 interviews with representatives of other UTS faculties, and other institutions, that have had success in the delivery of courses to Indigenous students, or other disadvantaged groups, formed the main basis of the research. Local representatives of the local Indigenous Communities were initiated via these schools. An assessment was also made of the resources of the Faculty of IT, and UTS in general schools with significant enrolments of Indigenous students were visited and teachers interviewed. Preliminary consultations with, that could be used to provide support to Indigenous IT students. Relevant literature was reviewed and web sites searched. Most importantly, Indigenous people already working in some area of IT were sought and, where possible, interviewed.

SOME FINDINGS

At the time of writing, the research for the initial project has been completed and its findings and recommendations are being considered by the Faculty. Here, our findings have been organised to address questions of the current potential for attracting Indigenous students to IT programmes, the kinds of programmes that might be made available to them and the options for providing support to Indigenous students once they have enrolled.

Awareness

History has taught us, and our own findings confirm, that if we are to succeed in increasing Indigenous participation in IT courses and the ICT industry then the participation of Indigenous people in the shaping of their involvement is essential. Our most significant and sobering finding was that employment in the ICT industry, and preparation for it by studying IT courses, was rarely even visible as an option for Indigenous people. Moreover, it appeared that IT was not included as an option by those who might advise Indigenous people about career choices. At best counsellors, and other similar advisers, had little understanding of the kinds of work available to people in the industry or how IT professionals might be trained. There appeared to be no perception of the differences between technology literacy and the use of computers, and the various kinds of skills required and roles available to trained IT professionals. We suspect, too, that the success of Indigenous people, in areas of traditional and immediate concern, such as law, teaching and health might be filtering Indigenous students directly into those areas so strongly that other options were not being considered. Moreover, there are few existing Indigenous IT professionals to act as role models for those still considering further training.

The Indigenous people we found who were already working in ICT areas had got there via other means. While still very few in number, they had moved into web development via design backgrounds or because they had needed to learn some IT skills as part of their existing jobs in Indigenous and other community organisations. We found no evidence that Indigenous people had any specific problems with learning and using technology, but there are major problems of access and awareness.

The implications for us are that no matter what kinds of IT programmes are available and/or developed for Indigenous students, they will be unsuccessful until such time as enough Indigenous people consider working in IT an option, and will consider enrolling, and are in a position to enrol, in the programmes available to them. This may mean that similar strategies to those commonly used to attract women to IT programmes can be extended to attract Indigenous students. But round 35 percent of IT students at UTS are women while there are only four Indigenous students (up from two as a result of this research project).

Feeder Programmes

These are tertiary pre-courses for Indigenous students who may then go on to further study. Some are domain specific and run by university faculties and TAFE colleges while others are more general. Domain specific pre-courses for Indigenous students are generally run over several weeks prior to the start of the academic year. The courses are intended to identify and accelerate the learning of interested students and to establish close relationships between the host faculty, students, their communities and existing members of the professional domain. The most successful pre-course is Pre-Law run since 1995 at the University of New South Wales. Over 117 Indigenous students have completed the programme and most have proceeded to undergraduate law studies. Indigenous tertiary colleges in the Technical and Further Education (TAFE) sector also offer pre-courses but these tend not to be domain specific. There is no well-developed and respected feeder programme for Indigenous students to enter ICT courses either at UTS or any other university.

Supplementary Programmes

Jumbunna IHL has offered a Supplementary Course for Aboriginal and Torres Strait Islander students (SCATS) since 1998. This is delivered concurrently with the first year of faculty programmes and subjects are offered in communications and mathematics. SCATS runs on a weekly tutorial basis and has been highly successful in providing Indigenous students with ongoing assistance to develop the necessary academic skills for achievement in university courses. There is currently no SCATS subject in IT although the IT Faculty has provided introductory, support programmes previously to all first year IT students. Extra tutorial assistance, funded directly by the Federal Department of Education, Science and Training (DEST), is also available to all Indigenous students.

Degree Programmes

Special degree programmes for Indigenous students are offered by a number of universities including UTS. These courses are most successful when taught in blocks (e.g. six one-week blocks over a year). Block release means that courses can be tailored for Indigenous students so that they are not permanently removed from their communities and can continue their work, family and community commitments while they study. To date, special degree programmes taught in block release all focus on Indigenous specific content such as Aboriginal and Torres Strait Islander Education, Indigenous Social Policy, Indigenous Health, etc. Some universities have included Indigenous content within their general degree programmes. This has the advantage of reducing the need for pre-courses, supplementary programmes and specialised Indigenous programmes while at the same time offering a more widely recognised and transferable qualification. But this strategy is most suited to areas, such as medicine and public health, where knowledge of relevant and identifiable Indigenous issues is already accepted as basic to the profession.

Student Support

We found that all educational institutions that have been successful in attracting and retaining Indigenous students have provided very high levels of counselling and social and cultural support. By high levels of support we mean a full-time staff member who will focus solely on the counselling and support programmes of students involved in a special degree programme. These institutions had also created a culturally appropriate and Indigenous-friendly space that can include dedicated centres within individual faculties and the main library. Financial support is crucial both as a result of the reduction in direct Government support to Indigenous students and increases in university fees. We found some Indigenous people who were eager to pursue IT training but who could not afford the fees, nor imagine being in a position where they would earn enough to pay off loans. Moreover, full fees are charged for all post-graduate courses in IT, including those designed as bridging courses to facilitate entry of people with undergraduate degrees in other areas into the IT industry. The school teachers and counsellors we interviewed all stressed that economic disadvantage means that few Indigenous students own computers. Most high school students who intended to study computing had computers at home as do virtually all undergraduate IT students.

RECOMMENDATIONS

We have made 25 recommendations in the report from this project. The main recommendation is that the Faculty of IT run a five year pilot project to increase the participation of Indigenous students in IT courses. This length of time would enable us to develop some awareness of IT as an option for Indigenous students, to develop support mechanisms for them once they have enrolled and to graduate Indigenous people to carry the project forward once the pilot phase has been completed. The priority in the early stages of the programme will be building awareness within the Indigenous Community of the options currently available in the IT industry while increasing our support for Indigenous students who wish to participate in our existing courses. We will need time to gather the resources and develop the expertise to design and deliver Indigenous specific courses.

The pilot project will be driven by a working group that includes representation from Jumbunna IHL. This working group will be responsible for implementing the recommendations of our report, including the procurement and organisation of necessary resources from the Faculty, the University and other potentially interested parties. An ongoing research strand is included as a central part of the pilot project. Reflection on the various initiatives of the pilot project is an important aspect of this research as is the continued effort to find Indigenous people currently working in IT and to gather their perspectives on technology design and use. But another aspect is an investigation of the potential contributions Indigenous people and their cultures can make to the ongoing development of both the technology that the ICT industry relies on and industry itself. We are acutely aware that Indigenous culture can offer great insights and contributions to a range of academic disciplines and professional domains. We would expect IT to be no exception particularly in areas such as knowledge management and supporting strong and robust communication between distributed groups of people.

In developing our recommendations we have been mindful of the complexity of the issues involved and have explicitly recommended action wherever we identified either an area of opportunity or an area where problems currently exist. Our recommendations have been summarised here to correspond to the structure of the previous section.

Building Awareness

Nearly half of the recommendations in the report were developed to support the movement of Indigenous students into IT as a non-traditional area of study. They include recommendations to:

- establish ongoing relationships with the two local high schools and the two local colleges with significant Indigenous enrolment;
- initiate dialogues with local Aboriginal Land Councils in the hope that support and involvement from Aboriginal Elders will drive the participation of the Aboriginal Community in the shaping of the programmes, encourage Indigenous students to enrol and, most importantly, to complete;
- seek out Indigenous people currently working in IT and encourage their involvement in all aspects of the pilot project, including the working group;
- invite the local professional IT organisations to participate in regular training days for counsellors and education staff at schools and colleges with Indigenous students and in the running of an Information Technology Week, where Indigenous students will be invited to participate in a programme of familiarisation with aspects of ICT that are particularly relevant to their communities and their culture.
- develop promotional materials for the Faculty's programmes specifically for Indigenous people that can be distributed via appropriate places and advertise the Faculty's programmes through Indigenous media.

Dedicated Programmes

There are a range of options for dedicated Indigenous programmes designed for different levels of expertise and different demographics within the Indigenous community. As a priority we have recommended that the faculty establish a Pre-IT Course for Indigenous students intending to study IT programmes at any Australian university. This would be a four-week intensive course including both Information Technology studies and tertiary preparation studies (computer literacy, academic literacy, and numeracy). Other universities and various industry groups would be encouraged to participate in the course.

We have also recommended that the Faculty consider options for the development and delivery of programmes in block release mode specifically for Indigenous students. For example there is some interest in e-commence programmes for people working in a variety of Indigenous enterprises including those located in regional areas. CISCO network training via the Faculty's CISCO Regional Academy is another potential area of IT training that could be delivered in a dedicated programme.

In the short term, however, we have recommended that the working group investigates opportunities for inclusions of Indigenous perspectives and issues within the existing IT curriculum. For example, the domain and context for some assessment projects in standard courses can be one that requires a consideration of these issues and perspectives. Indigenous people are the domain experts in the major interaction design project in the existing undergraduate Human-Computer Interaction subject.

Student Support

The remainder of our recommendations are concerned with increasing completion rates by providing appropriate support for Indigenous students once they have enrolled in our programmes. A full investigation to determine how best to support Indigenous students once they are enrolled in the Faculty still needs to be undertaken. The initial report includes recommendations to:

- work with Jumbunna IHL to ensure that accessible and effective tutorial assistance is available to Indigenous students from the beginning of the first semester of enrolment;
- ensure that students enrolled in IT courses have access to computers at their homes;
- employ and train Indigenous staff to be involved in, and eventually manage, all aspects of the programmes directed to Indigenous students;
- establish a mentorship programme for Indigenous students with at least two levels; Indigenous students could be mentored by individual members of Faculty staff and / or by recent graduates;
- set aside culturally appropriate space for Indigenous staff and students within the Faculty that can function as a centre of support and communication for students;
- make available a generous range of scholarships and cadetships for Indigenous students at both undergraduate and postgraduate levels particularly while the first generation of Indigenous IT professionals are trained. We will count it as one measure of the success of this programme when all such scholarships and cadetships are filled. We found a number of organisations willing to provide cadetships but the mechanisms for doing so still need to be established.

THE NEXT STAGE

We have included this discussion of our recommendations to show the range of activities we feel are needed if we are to increase the participation of Indigenous Australians in IT courses. Sadly, none of our recommendations will be trivial to implement successfully. We are now preparing the plans and strategies, and gathering the resources to continue the project.

We recognise that there is some fundamental and wide ranging educational innovation required in this project. It represents one of the first attempts in Australia to open a area of study to Indigenous people that has not been traditionally associated with the immediate needs of their communities. Historically, our immediate challenge is to graduate a first generation of IT professionals just as Health and Education faculties started to do, some 20 years ago, and Law and Business faculties have done since. At the same time we need to initiate opportunities for Indigenous participation in the shaping and delivery of IT programmes and projects that may have specific relevance to them.

Participatory Design has the potential to be used not just as a method for technology design but, most importantly, as a rich and relatively well-developed resource for negotiating and designing participation in, access to, and appropriation of IT by Indigenous Australians. It is unique among technology design methodologies and practices in its deliberate and systematic blurring of the distinction between the users and designers of technology. As such it can offer support for the development of Indigenous use of IT into the Indigenous design and development of IT. The insights from Participatory Design practices, including the tools and techniques for involving participants in the design process, whatever is being designed, will continue to inform the evolution of this project.

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Consulting the citizens Relationship-based interaction in development of e-government

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ABSTRACT
This work-in-progress report explores the multi-layered discourse on interaction within the field of e-government, heavily influenced by marketing-, and democracy-related values. The discourse hold out the prospect of an on-going transformation towards what could be labeled "relationship-based interaction", aiming at involving citizens actively in development of public information and services on regular basis. Municipalities and official authorities are taking various initiatives to reconfigure their relations with the citizens on local and regional as well as on a national level in Sweden, of which some local examples are presented in this paper. This article also reflects upon possible ways to promote public involvement in development of government, by the use of participatory design influenced methods and tools.

Keywords
24x7 service, relationship-based interaction, service design, e-government, public administration, discourse analysis

INTRODUCTION
Local governments and municipalities have a wide range of societal expectations and demands to face, concerning a total renewal and transformation of public administration in accordance with the notion of 24x7 Agency[17], which is generally seen as "The Way" to future government in the Western world.

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A key issue, according to the on-going debate on development towards the "24x7 Agency" [17] in Europe[1] is how to move beyond a prevailing tradition of hierarchical communication between authorities and citizens, into a dialogue-model based on horizontal structures and networking [1] [13]. The main objective of this paper is to initiate a discussion of what could be characterized as new processes of relationship forming, including various actors, in order to establish and stimulate *relationship-based interaction* between authorities and citizens. Practical examples of this are the declarations and dialogues [19] around service design[2] and that are taking place on local and regional levels, in various parts of Sweden.

Models of e-government
Research and evaluation, mostly within Political Science, from Great Britain and the United States[3] concerning e-government, show that handing out information hitherto has been the main goal for national and regional authorities in England and USA [1][13]. Using new technologies for citizen feedback and stimulating participation has not been of the same importance. In the rare cases when feedback is gathered from the citizens, this is done by collecting opinions upon predestined issues rather than giving the citizens the opportunity of having a say on design issues [1][13]. The transformation from an "authority culture" into a "service culture" has proceeded gradually during the last decades in Sweden [8][16]. The scope of focus has shifted –

[1] The Swedish version of this concept is developed further in [17].

[2] Basically, including citizens' needs in development of online public services.

[3] The development of e-government in both Great Britain and USA and Australia are considered as role-models for the Swedish Government according to SAFAD, (Swedish Agency for Administrative Development.)

at least in the ongoing discourse – from enlightening and guiding the citizen, towards taking the starting point from the citizens' point of view and lately also "consulting" the citizens and actively involving them in development of public services.

EMPIRICAL BACKGROUND

The discussions in this paper are mainly drawn from experiences and materials gathered during work on two separate inquiries, conducted within the framework of the DitA project, Design of IT in Use,[4] As a third source, I have used experiences and reflections from my previous work with the Dialogue project, a Trans-European project, aimed at developing the use of ICT as a means for furthering democracy and methodological development.[5] I am also currently involved in research concerning municipality initiatives on setting up and working with user evaluations.

The RISI+ evaluation and the PIM project

The first inquiry (henceforth called RISI+ -evaluation) was a study initiated by the EU, DG Employment and Social Affairs, carried out as a commission and follow-up on the Regional Information Society Initiatives, mapping stakeholders' and citizens' experiences, access to and requests for public services on-line. The material was mostly gathered through interviews and observations of technologies-in-use. The second inquiry, The PIM-project, is an evaluation of the implementation of a self-service system, initiated by official authorities in Sweden, The *Swedish Public Internet Monitor Project*, (henceforth called the PIM project), and conducted in co-operation with two other Swedish universities – The Royal Institute of Technology and Mid Sweden University. Public Internet monitors and their use were studied mainly through observations and interviews with locally responsible "monitor-hosts" and end-users.

Text analysis

My theoretical and methodological basis is also inspired by critical discourse analysis, originally developed by Norman Fairclough [23], concretely exemplified as readings and analysis of both national and local official texts and formulated visions concerning developmental work within the area of e-government.

THEORETICAL INFLUENCES

In accordance with Suchman et al. [20], which summarizes the last twenty years of research in the field of participatory design (PD), there are three interrelated lines of inquiry, which are to be seen as the main constituents of what could be defined as an approach striving to achieve "ethnographically-based design of digital technologies"[20]. According to the authors the core research within the PD-field consists of: *critical analyses* of technical discourses and practices, *ethnographies of work and technologies-in-use* and *design interventions*. [21]. The main focus in this report is the first mentioned line, critical analysis; the other lines will be emphasized in future work. The history of PD-research are also described by Kensing & Blomberg [14], Gärtner & Wagner [12] and the Scandinavian Research projects on system-development inspired by PD, are also discussed by Bjerknes & Bratteteig [2]. In another article Lucy Suchman [22] addresses the complexity of design at work, [22][11] the blurring of boarders between professionals and more or less "invisible" actors, of which I pose citizens are an example.

Relationship-based interaction

Tracking the main route in the discourse on interaction in e-government, leads us to what can be defined as a management- and marketing related discourse. Philip Kotler, an American "guru" and initiator of the concept of *relationship-based marketing*, poses that: "*Our thinking […] is moving from a marketing mix focus to a relationship focus.*" [15].

Several of the respondents in the RISI+ evaluation relate development of e-government with the issue of marketing the municipality or local region. Citizen involvement in service design is considered essential for qualitative reasons, and seen as an important instrument in the future for marketing a municipality. A respondent relates *relationship-based marketing* with development of public services in the following way: "*The main idea with the notion of 24 hours authority is to make interactive interchange around services possible but...we haven't got this thinking yet, as they have in marketing, that there are possible channels, but we have to manage them*."

In Swedish marketing literature, the approach of *relationship-based marketing* are outlined and substantiated with terms such as *long-term co-operation* and *equal partnership* [10]. All parts are accountable for what goes on and what does not happen in the relationship. These values are defined as core relation- and service values and seen as intrinsically 'good'. Increased value for the customer has to be the main goal, which is achieved by creating *activity links*, *resource ties* and by developing *actors bond* [10].

GOVERNMENTAL "WISHES UPON A STAR" DIALOGUE

At the request of the Swedish Government, the Swedish Agency for Administrative Development (SAFAD), in 2000, presented a proposal for a definition of criteria for the notion 24x7 Agency and how it should be applied in the ongoing development of e-government in Sweden. The

[4] The DitA project. Design of IT in Use; supportive technologies for public services. More information at http://www.iar.bth.se/forskning/arbv/dita/index.htm and in [4].

[5] See http://www.ronneby.se/dialogue/default.htm and [7].

emphasis is put on "*increased accessibility"*[6] and "*availability*" for the citizens, as well as improvement of the "*quality of services"*. The citizens are placed in the centre and the development of "*network-based electronic interactivity*" between different actors is considered to be the main-goal. A follow-up on how the development of a 24x7 service is proceeding was recently conducted and presented last year by SAFAD [18]. The government commission concerning 24x7 Agency stresses the importance of developing methods for analyzing information- and service needs based on a customer perspective [17]. According to this commission the authorities have to apply a range of methods for supporting and stimulating the development of a relationship-based communication, i.e. through management dialogues, service charters, continuous follow-ups and customer surveys, focus groups and so on. All in the name of renewing the dialogue around services. As it says in the report: *"The 24 hours agency must be keenly alive. It has to be alert and constantly listening to the citizens - it must consult the citizens. Consulting means seeking advice from, taking counsel, deliberating, but also listening to and thinking upon. The consultation then becomes a way to create participation."* [17]

Case number one: municipalities

A strategy on development of public services was recently discussed and accepted by the local city council in one of the municipalities within my empirical study. Several proposals of how to force the development of public services are presented in a policy document. The citizens are "included in project work, invited to join courses and to provide feedback". A scenario is presented: "*On the Intranet, you can find an education–package for politicians on how to enhance democracy. A focus group consisting of local inhabitants and politicians is testing how the ideas are to be implemented in "real life", this is just one of many ambitious ideas on how to create a better communication among different actors…."*[7]

The same Swedish municipality was planning to reshape their website. A young designer was commissioned to make a new fresh design. The re-designed site was sent out to the municipal employees in order to get feedback on the renewal of the site. The response was overwhelming, and certainly not as positive as expected. This looks like "Disney World Park or a candy-store"[8] is just one example of the reactions. The chief of information then adopted a totally different approach and set up a group of referees, consisting of users representing different ages and groups, within society. During the meeting the citizens were merely asked for opinions about the functionality of the new website. The municipally employed chairman said the following, at the first meeting with the selected user group: " *I think there is a need for continuous consultation with users in order to develop the website and all the services."*

The citizen's feedback then was taken in account in the next remaking of the website. Another municipal officer, in the same city, commented the plans on recurrent user evaluations in the following way: "…*we are thinking of combining these activities with training, giving people an opportunity to develop their computer skills."*

Case number two: a governmental pilot

The European Commission and the Swedish government emphasises the policy "IT for all".[9] One concrete example of an initiative to increase access for disadvantaged groups in society is the *Swedish Public Internet Monitor Project* (the PIM project)[10]. This project was started as a co-operative initiative between different authorities, aiming to co-ordinate their public services and make them accessible to the general public in alternative places, for instance in libraries and other local meeting places. The self-service system (basically a built-in terminal and a shared Internet portal, called 'The Citizen's Square') is intended to guarantee a basic democratic right: easy access to comprehensive public information and services. Five Swedish authorities, the Employment Office, the Social Insurance Office, the National Board of Student Aid, the Premium Pension Authority and the National Tax Board was co-operating by the time of the evaluation. The Swedish Migration Board and the Swedish Consumer Agency recently joined the project.

During an internal meeting in which representatives from all the steering groups of the authorities took part, the issue of

[6] All quotes are presented in italics, available in Swedish at http://www.statskontoret.se (Translations by author.)

[7] "E-center or Learning-resource-center. A virtual and physical arena for development of applied ICT; citizens' services and learning". Presented during a city council – meeting in 2002.

[8] The originally quote was referring to a well-known, Swedish amusement park.

[9] This was emphasized in the words of the Prime Minister of Sweden, Göran Persson, at the opening of the parliamentary session in September 1999-09-14

http://www.riksdagen.se/debatt/9900/prot/2/htframe.htm

[10] See http://www.medborgartorget.nu

8 eedback from citizens was addressed in terms of "how to create better interactivity". In the discussion several ideas were given as examples, such as: managing errands on-line, careful, planning and conducting of needs assessments, actively incorporating users' or citizens' feedback in service design. However, when the organisational schemes for further development and maintenance of the project was sketched on the white-board, the word citizens was not mentioned or included at all.

The hosts[11], and other members of local working-groups, give concrete examples in the interviews of how to manage an increased interactivity through sharing work-practice experience and by taking active part in a continual process of "local tailoring" of the services: "*...we have discussed establishing some sort of continual sharing...the simplest way could be to man the various authorities' help-desks and thereby get in-service training. /…/*

In the evaluation parts concerning accountability[12] issues and influence, the responsible authorities had visions of establishing a chain of interlinking anchoring-processes, in order to sustain liability of interaction and management. But it did not always work as planned, which is exemplified by this comment from a member of local working-group: "*We could have developed the dialogue around support- and activities for users further, but the question is who is responsible for doing so? If the authorities put more emphasis on it, we will gladly take part. They can't mean we have to start a lot of training of people, without getting any support or resources to accomplish this.*"

The citizens who were using the self-service system also talked of feedback in terms of "their duty of reporting things to the staff", who in turn are expected (by the citizens') to pass on the information to the developers and ultimate owners and managers of the monitor.

CONCLUSIVE DISCUSSION

The analysis of the discourse on interaction within e-government, in texts and practices, shows that different actors, including stakeholders from the governmental arena as well as local municipal officers and citizens, responds to the changing approaches on interaction in various ways. The relationship-based interaction is motivated by quality reasons, as an instrument for marketing. The concept is described in terms of interchange around services, management of relations, mutual accountability. The discourse depicts the interaction as a constant activity of consultation and listening, deliberation and "thinking upon" the citizens. In local practice the linking of citizen's services and continual learning, as well as incorporation of citizen's feedback in service design, is emphasised. The actual users of the services (local employees and citizens) express their need of defined responsibilities, support and resources and state that they have a "duty" to report breakdowns and insufficient functionality. There seems to be a need for developed methods and techniques for "consulting" the users. This gradual transformation – which actually is taking place – is shaping and influencing the ongoing dialogue in the direction towards what is often referred to in the discourse, without further problematization, as relationship-based interaction. Long-term co-operation is discussed and explored, in terms of developing regular methods on how to get a hold of and put words on "the public will". The service declarations could be seen as a way for the authorities to give account on their service and establish a contract with the users, and thereby open an invitation to discussions on development of services with citizens. At the same time as this willingness and readiness to take into account users' or citizens' feedback and to start up a continuing dialogue are expressed, we see several examples of feedback failure in local practice which highlights the risk on creating what instead could be described as a "detached engagement".

A basic question must be; what is in it for the citizens? And there is definitely an opening here for exploring and expanding the notion of relationship-based interaction further, by acknowledging the connection between developing skills and providing feedback for different purposes. The will to create activity links, such as continuing evaluation of websites and identification of needs through focus group interviews is still rare in the examples, and the resource ties are possible to distinguish for instance in the shape of offering basics in computing to citizens. The actors' bond could be exemplified by the demands on citizens to give their feedback on request. The interaction is still performed as single activities, (the user-evaluation of a proposal on a renewed website), but there are potentials on developing a continuing consultation with citizens. Relations need to be structured, though, and mutual exchange and transformation of knowledge and information need to be enhanced. The vision of seeing the citizen as a strategic partner in this development is significant for this kind of interaction, but what does it really mean, when it comes to basic involvement and participation of citizens in design-related issues? The aim to develop public services is closely interwoven with the aim to achieve organisational change as well as societal development and to strengthen democratic values.

The various attempts to establish a relationship-based interaction seems to be conducted in an unconscious way, which of course is good for a start, but the methods could

[11] Basically the responsible person, within a local institution, that provides the Swedish Public Internet Monitor.

[12] The concept of accountability is further developed in Eriksén [10].

be strengthened by taking into account the competencies of participatory design methods on incorporating a multi-perspectives in service design as well as technology production and use, and thereby stimulating other strivings.

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Framing Participatory Design Through e-Prototyping

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ABSTRACT

The paper discusses how a new way of prototyping can serve as a method to support a participatory and evolutionary design approach within Web projects. "e-prototyping" is meant to frame participation of Web users and other stakeholders in the design process through providing and maintaining a variety of communication channels for (user) feedback on frequently released software versions as well as establishing a steering board which takes into account the users voice in sorting out the feedback and setting priorities for the following design effort. From the software process perspective, e-prototyping supplies the development arena with the information needed (i.e. requirements), thus embedding the design activities in a loop of continuous communication and learning.

Keywords

Participatory design, e-prototyping, Web projects, software development

INTRODUCTION

Prototyping has become a well established method within participatory software design (we use the term design to embrace also software development and deployment), even though it does not resolve all the difficulties on the way of successfully integrating the users' perspective in software processes. However, as software design projects are increasingly focussing on Web-based applications (such as in e-business, e-government etc.), a number of new circumstances increase the difficulties of applying prototyping as a method within participatory design (PD):

- Use situation: As new technology enables new forms of IT use, the relation of Web-based software and its users is much less tangible. Users are often unknown, and other products/services are "only a mouse click away". Web users often have more choices on which application they want to use, but less choices how they want to use it (e.g. users have no control concerning software updates, configuration etc).
- Software process: Content and style are, for Web users, at least as important as the tool functionality. Therefore, the development of Web-based applications involves different kinds of experts and professions (beside the software engineer). To keep Web users attracted, most design projects strive for short term innovation whereas project ending is often not predefined.
- Organizational environment: Web projects are usually embedded in far reaching networks of stakeholders crossing many organizational boundaries. At the same time, cooperative relations are less obliged and partners frequently drop out, become substituted, or the network extends more and more.

Taking this into account, we find that "traditional" prototyping is based on assumptions which are not (or only partially) valid for the development of Web-based applications (regarding e.g. actors involved, organizational frame, communication, time frame, controllability and relevance of application). From the developer's point of view, as the frame for the user-designer-interaction through prototyping seems to dissolve, one needs to ask:

- How can prototyping still support participatory design in the world of networked and distributed systems?
- What kind of modifications are necessary in the management of software design projects?
- How can the organizational environment of design processes still accommodate participation in bringing out Web-based applications?

In this paper we seek to frame PD through (1) analyzing the gathering of requirements and the involvement of different actors in developing Web-based applications, and (2) proposing to integrate evolutionary software development and prototyping based collecting and evaluating feedback from users and other relevant actors in "productive mode", accompanied by various communicative and organizational measures to ensure that the users voice has a say in the design process.

IN SEARCH FOR FRAMING PD IN WEB PROJECTS

Prototyping has been discussed extensively in application oriented software engineering as well as in PD. From the software developer's perspective, e.g. Sommerville ([13], pp. 138-153) describes it as a means of requirements analysis

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and validation. Prototypes support the communication among developers and users, by enabling them to "experiment with requirements".

In addition to the developer centred methods, cooperative prototyping [4] is an approach in which the process of creating and evaluating prototypes is seen as a cooperative activity between the future users and the designers of a product. By letting users play around with prototypes in simulated or real use situations, problems that occur can be analysed and solved. This way "users can participate actively in improving the prototype" ([3], p.170). Cooperative prototyping puts an emphasis on the learning aspect of the process – prototypes are therefore an important type of artefact and a source of insight in a continuous learning process.

From an participatory design point of view, future users as well as other actors should be well integrated also in the development of Web-based applications. However, there are several problems with implementing PD principles in this domain. In this paper we focus on the development of Web-based applications and services for unknown user groups. We will not discuss corporate intranets and extranets in which developers can relate to a well defined group of users and other actors (for intranet development see e.g., [5],[11],[12]). Most of our findings will also apply to e-commerce systems (comprising classical shop and auction systems), although we will not address the specifics of workflow and transaction management.

In this section we point at the new conditions, difficulties, and challenges of gathering requests/requirements and communicating with the relevant actors. Our findings are mainly based on our involvement and experience in two projects: the development of CommSy, a web-based application designed to fit the needs of project-based learning groups [10], and of www.hamburg.de, a city portal and interactive Web-site [2]. Our evaluation of the project cases showed that the following questions arose repeatedly and turned out to be crucial from the point of view of software development:

- How can the (initial) requirements for network-based Web applications be defined?
- How can the requirements be gathered systematically, if the target users of the system (the Web users) are unknown and hardly describable in their characteristics?
- Which actors should participate and how?
- What are the consequences for requirements gathering and the development process of the continuous expansion of the technical system that supports the applications?

We claim that these problems arise in many Web projects. In "traditional" software projects requirements usually relate to milestones structuring the overall software process. Within these processes, prototypes are usually built in order to gain new insights and support decision making if applicable, embedded in the iterations of requirement analysis, prototyping, realization, releasing the product and revising. Web projects do not enjoy this kind of freedom:

- Any software released to use on the Web is without protection: publicly accessible Web prototypes are always exposed to public criticism– no more "playing around" with a development system.
- Initial requirements are defined by the providers' view for a potential application (the wishes and demands of the current user group will become evident only through the first running version of the system).
- Each feedback round with users needs time to prepare, present, communicate, and evaluate. But strong market pressure and high expectations usually do not allow Web projects to wait for this.
- Web users expect new versions regularly, especially when waiting for requested functionality.
- This leads to considerably shorter development cycles and consequently to pressure on the developers to define work packages for shorter time periods.
- What e-applications have in common is that they are "early adopters" [11] in their domain, i.e. they offer a new service on the Internet. Development has to keep in mind that the application is expected to feature high quality and innovation.

With more groups of actors being involved, recognizing and acknowledging the different perspectives becomes a crucial task for requirement gathering within projects. The relevant actors cannot be represented within a simple actor model (e.g. including developers, users, and management). Actors contributing to the system development take on new roles such as "technology champion" [5], (sub-)service provider, and others. Also, we can still identify well-known roles such as contractor (the financier of the project), user, developer and customer, but there are significant shifts in interest:

- Contractors, at least in principle, expect a return on their investment. But Web projects are often not accountable in terms of rationalization effect, the result may be an image improvement, an increase in market potential or an expansion of the service portfolio, and in many cases project investments are 'strategic' with no clear-cut criteria for evaluation available.
- With Web applications, the software users are often also the customers (or clients) of the organization contracting the development (in contrast to "traditional" projects, where the users work for an organization creating some value for

external customers), thus changing the relation between the user and the contractor.

- The user group is not well defined and profiles are hard to obtain (unlike in companies, where users can be characterized by their jobs or functions).
- New roles can and should be identified, e.g. strong complainers criticizing errors or missing functions on a regular basis, volunteers trying to play an active role in the further development of the Web application by spending a lot of time on evaluation and making constructive suggestions for improvement.
- The developers' main task is to develop and integrate a system in a given environment (coping with existing or predefined technology) and to make it run reliably. The developers' perspective is focussed on keeping the software error-free, making the latest back end technology run, and implementing state-of-the-art features. Their use perspective is mostly limited to one of a "power-user".

In Web projects, the different actors with their perspectives and interests are often not part of the same organizational unit which precludes direct and personal discussions (e.g. users or decision makers cannot easily be invited or are not available for single or group interviews) or even simple user observation. In addition, without a common social frame (the organization) users are more difficult to motivate for participation: Internet users, in case they dislike the application, will just stay away, and organizational users in remote locations mostly feel they do not have a say anyway.

Furthermore, Web projects are facing new operating conditions which become visible step by step as the application is already in productive mode with reactions from "real" users. Thus requirement gathering in Web projects cannot make use of "traditional" prototyping as many presumptions no longer hold true. Bringing in the perspective of the manifold relevant actors and giving them a voice in the design process of Web-based applications needs new approaches.

HOW TO DO E-PROTOTYPING

In this section we suggest e-prototyping as an approach to create an environment for integrating users in Web projects through the use and evaluation of consecutive software versions. Firstly, from the developers' point of view, we argue that the current trend in software engineering towards shorter development cycles leads to an intertwining of prototyping and release management. Secondly, we describe the steps of our e-prototyping approach in comparison to "traditional" prototyping activities. Thirdly, we show how obstacles in the user-developer relation can be overcome by promoting and integrating communication into the development process.

Speeding up cycles in software development

Shortening development life cycles is an issue in various fields of software engineering (e.g. for the German software industry see [14]). Lately, the approach called Extreme Programming [1] has gained much attention, calling for shorter cycles on all levels of software engineering in order to increase the quality of a software product. The system should grow constantly through continuous integration and frequent releases. This approach has been applied extensively in the CommSy project, in which discussion forums were used to gather feedback, which in turn was regularly discusses in an architecture group.

Frequent releasing is also very common in projects of the open source community [9]. There, a two-way communication (user feedback and reports on development) is critical (e.g. Mozilla project), posing new management tasks to the project. This is in line with our experiences: in the CommSy project, the number of system users and of use settings increased rapidly so that the developers lost direct contact to the end-users. The hamburg.de project at first failed to produce frequent releases and user communication, which resulted (among other) in users "misusing" the guest book to file complains.

In short, evolutionary approaches and systematically making use of user feedback seem to become state of the art in application oriented software engineering. Moreover, in Web projects these development approaches have to be intertwined with the 'productive mode' of any software developed. We see e-prototyping supporting an evolutionary approach for Web projects based on short development and release cycles with each of the releases being treated as an e-prototype for the next development effort.

Steps in e-prototyping

Within evolutionary and participatory software development, cyclic approaches were suggested as early as in the 1980s, putting emphasis on the communication between developers and users. E.g. the STEPS model [7] proposes development cycles consisting of (1) revision establishment, (2) production, (3) releasing a system version and (4) application of the version. Based on this kind of approach, we propose to realize prototyping within an evolutionary Web application development process. Framed by the four steps of evolutionary prototyping [6] – functional selection, construction, evaluation, and decision on further use – we outline how to do e-prototyping (see figure 1):

1. In order to perform a **functional selection**, requirements need to be gathered. In the area of Web applications, as the user group cannot be determined beforehand (or at least only very vaguely), initial requirements have to be anticipated [8] at the beginning of the project by the members of the development teams, the (Web) provider organization, and/or the business partners. It has proved

useful to gather the actors involved in a so-called "steering board" which can also include user representatives. At the beginning of development the goal in mind is "to go public" fast, to reduce the "time to market", to face the discussion with the users of the new system version within a short time, and to integrate users into the development process as soon as possible. The plan for the first usable version should cover only essential functions that can easily be handled by the developing team. Therefore an appropriate functional selection is the basis for a cyclic development. In the hamburg.de project this approach was adopted after the failure of a big-bang approach. The experiences gained during each cycle help the developing team to master further steps in the development. The functional selection in the next cycles is then based on decisions from the steering board evaluating user feedback (see below, steps 3 and 4).

2. In each cycle, **construction** focuses on technical and functional requirements selected. This way the CommSy project accomplishes to fix mostly all reported bugs so far and add some new features. After construction the software is released, i.e. made accessible for use through the Internet. It will then be treated as a productive system by the people who use it, although it is regarded as a prototype from the development perspective and used as "a learning vehicle". In contrast to "traditional" prototypes, it is being used in real life conditions, and is not labeled as a prototype. In that respect, e-prototypes as releases must therefore meet higher standards than "traditional" software prototypes, which puts additional pressure on the developers to strive for high quality. Construction must aim at a working system as a precondition to obtaining and evaluating user feedback.

3. The **evaluation** heavily relies on communicational means established in parallel to the use of each e-prototype/release (see also next subsection). Feedback concerning the current software version may consist of error reports collected from users and system administrators, usability problems excerpted from discussions, and additional (and new) requirements of the users (technology pull). Error reports, usability problems, and additional requirements are collected and published through diverse communication channels. E.g., channels in the hamburg.de project were the guest book and a call center, and the CommSy project utilized mainly discussion forums. Calls for new 'strategic' applications from other stakeholders to gain a competitive advantage (technology push) are also collected and discussed in the development team and the steering board.

4. **Decisions on the further use** of the software version (the e-prototype) are based on the evaluation. The decision on the further use is made from the management perspective (steering board) and is closely related to the next cycle's functional selection. It is influenced by users, providers and other stakeholders from the application domain to integrate their view into the development process. E.g. decision making took place in the steering group of the hamburg.de project and in the architecture group of the CommSy project.

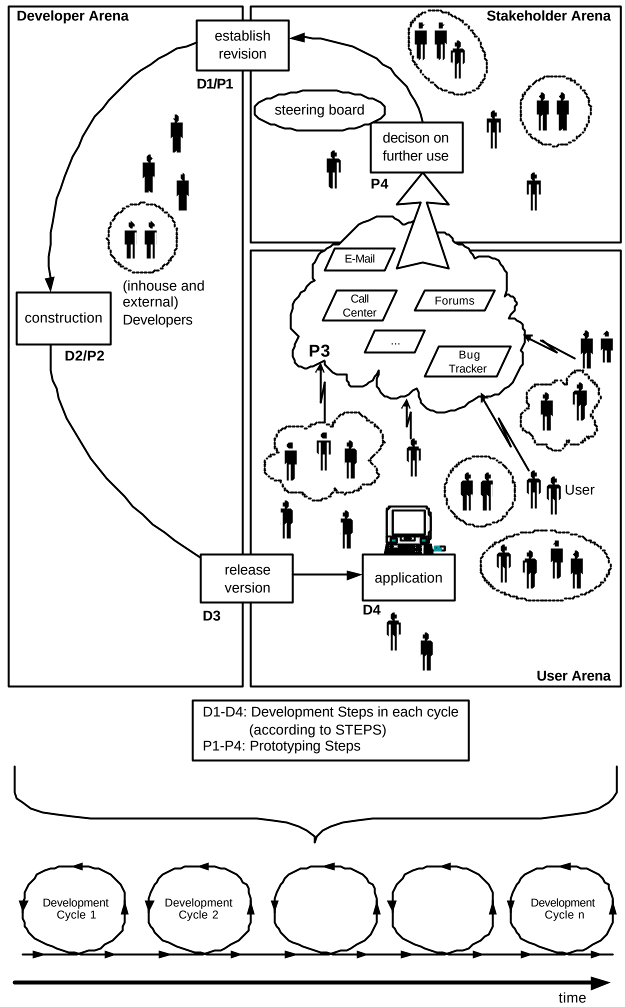

Figure 1: The e-prototyping cycle supporting evolutionary participatory design

These four steps can be regarded as one cycle in an evolutionary software development process framed by the prototyping approach. The decisions taken after evaluation give input for the next cycle starting with functional and technical selection prior to the construction of the next version. The requirements for the follow-up version (based on necessary corrections and selected innovative changes) should be limited in such a way that the construction and release of the next version (e-prototype, release) will not take longer than three months. The hamburg.de project first struggled with the cycles (in fact it failed to realize a big bang release) but then accommodated to releasing versions every few months. Within the CommSy project some cycles were shorter than four weeks, which made it difficult to impart those new version to the users.

Communication and Management

As communication between users and developers is essential for driving the prototyping process, we need communicational means to help establish some interaction with the (mostly) ”unknown” Web users. The following channels have proved to be particularly useful: email sent to an address reserved for that purpose (e.g. feedback@web-organization.com), a call center where users’ problems and suggestions can be recorded, and a Web site containing error report forms, and electronic discussion forums. As far as possible, contributions and calls have to be answered if necessary. In both our projects establishing and maintaining the channels has been a challenge of its own. Above all, the feedback from the various channels needs to be gathered consistently to support an efficient evaluation.

User participation within Web projects relates to a unique ”cultural” background of the Internet community. There, users often voluntarily take an active role in a project without directly deriving any benefits from it (cf. newsnet forums), e.g. because they are interested in a particular software. For the successful interaction between developers and users, it is important that these users feel that they are taken seriously and the software provided is ‘reliable’ (which implies, among other things, an assurance that support is available for those voluntary users in case of a software causes serious damage on the user side).

Updates of a running e-application should be made at short intervals (3 months at maximum). Bug fixes (patches) are required more frequently to keep the above mentioned feedback channels clear of error reports. The more ”buggy” a system is, the more of the communication is about errors or the existence of bugs. In the end, only a bug-free system enables the freedom for communication about advanced functionality and usability.

Software processes management applying e-prototyping must strive for short releases, communication, and innovation. The process described is much less controllable as it is in ”traditional” software development. For example, a successful application attracts more users, which leads to a greater load on the system and in turn provokes problems and erroneous behavior. As a consequence, a redesign of the system’s architecture might become inevitable. Thus the emphasis of development activities can shift from a solely functional oriented approach to a structural redesign in order to meet demands of scalability and a high load service. Additional security needs on the part of the user can lead to safety features within the system initially not foreseen and planned. Also, market pressure is another factor that contributes to very short development intervals and frequent releases of innovative system versions.

To manage the outlined process, all feedback collected from the different channels must be associated with a particular version and evaluated by a steering board. They decide what to put on the development agenda. This is the foundation for the next release addressing bugs which should be removed immediately and feature enhancements. Persons reporting a bug should be told about improvements directly. It should also be made clear at what point the improvements will be integrated into the live system. In order to avoid duplicate reports, information about known problems should be available to other users.

CONCLUSION

In this paper we discussed how a new way of (e-)prototyping can serve as a method to support a participatory and evolutionary design approach within Web projects. Based on short cycles of software development and release, e-prototyping is meant to frame participation of Web users and other stakeholders in the design process through providing and maintaining a variety of communication channels for (user) feedback on frequently released software versions as well as establishing a steering board which takes into account the users voice in sorting out the feedback and setting priorities for the following design effort. From the software process perspective, e-prototyping supplies the development arena with the information needed (i.e. requirements), thus embedding the design activities in a loop of continuous communication and learning. However, future research needs to verify the hypothesis that e-prototyping provides an appropriate general frame for PD of Web-based applications and/or to analyze the methodological, organizational and political success factors for such kind of endeavors.

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Negotiating Information Technology: Politics and Practices of the Public Sector Web Production

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ABSTRACT
In this paper I do a preliminary investigation of the web production in one Swedish municipality. I implement Gä rtner & Wagners suggestion of thinking through three arenas when studying design processes: Arena A for individual projects, Arena B for the organisational layer and Arena C for the national arena. The arena C, the National politics draws up the ideological scene available for the information technology translations at the local level. The Arena B is a municipal political IT-vision document. The arena A is the analysis of an interview with a municipal web developer. I implement the analytical tools of the actor-network theory (ANT). I suggest that the web design process is a network of negotiations, where political documents, web producers, private companies, software, and time meet.

Keywords
Politics, public sector, web production, Sweden

INTRODUCTION
I am investigating information technology understandings, interpretations, and translations in the public sector i Sweden. The original main focus of my research was to study the co-operation between the technology staff at the IT-departments and the administrative personnel working with web-based information production. A rather straight forwarded and explicit perspective following the participatory design ideas and experiences. [1]

In quite early stage it became evident that the empirical material did actually not focus on the relations between the designers and the users. Perhaps this indicates that the boundaries between the designers and the users are not that firm and clear and where the place and function of the user is becoming more and more blurred: ”As they [=informati- on technologies] move from the realm of experts into the workplace and mingle much intimately with other activities, the idea of computer expertise and the boundaries between developers and users are questioned…”. [2].

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In the interview, there were people, machines, places, memories and experiences interacting and intertwining. The question that arose was: “How should one take care of all the different elements and bring them together into one analysis and one story of local information technology practices?”

If the process of the web production was a mixture of extremely various elements, the next question was how fruitful it would be to expand the notion of design to embrace a wider network of negotiations and actors. Joan Greenbaum and Dagny Stuedahl, who have studied design and development of commercial web sites, have implemented the ANT-perspective of negotiations and interactions between human and non-human actors in their analytical work: “Through a focus on negotiations between actors, and the translations and transformations needed to end up in a delivered product, we found it particularly useful for helping us to identify intermediary moments in time and place where designs, specifications and software code were changed through actions by people, prior events and pieces of the technical infrastructure (non human interventions).” [3] Inspired by the ANT-perspective I have tried to be sensitive when thinking about the actors of design not only limiting to people and their internal relations but bringing together humans and non-human actors.

I also became more and more conscious that the public sector information technology definitely does not exist in a isolated vacuum. Johannes Gärtner and Ina Wagner talk about three different kinds of parallel arenas in a context of system design and participation. [4] According to them there are different actor spaces involved in a design project. They use the notion of arena A when they talk about designing work and systems at the local level. Arena B is the space for organisational frameworks. The third arena C is the political arena. What is important to think of is that these arenas exist parallel and influence each other. They do not though form a hierarchic pyramid, where the traffic (read control, steering, resources etc) is always and necessarily from top to down. Of course, if there are for example changes in the legislation system and funding opportunities, these changes directly influence the activities at the local level. The local level although has opportunityies for its own implementations and interpretations, and perhaps the Arena A is also a space for resistance or re-negotiations.

I have identified three parallel arenas following the thought lines of Gärtner and Wagner. I call these three arenas: National politics, Local politics and Local practices. In this paper I will present some of the main themes and findings from each of the arenas.

In the concluding discussion I will reflect how the idea of arenas and the ANT-perspective can influence the analysis of the processes connected to the design of municipal web. Would it be possible to think about the web design as a network containing a chain of negotiations? Can the arena thinking together with the ANT-perspective help to uncover and understand the complexity of the everyday design practices?

Arena C National politics

One of the key texts articulating the dominating national understanding of information technology in Sweden is the government bill "Ett informationssamhälle för alla" [Information Society for All] (later called GB in this article) with the proposition number 1999/2000:86. [6] A governmental proposition is a link in the Swedish legislative chain meaning that a proposition is a proposal for legislating new laws or changing already existing laws.

Theme 1 Hubris/to be best or at least among the best ones

One of the themes that seems to be very central in the text is to understand that information technology is a competition between nations, where it is of great importance that Sweden either is the leader or at least among the leading nations.

This theme is the umbrella theme where the landscape of necessity and importance is shaped. There is hardly any space for negotiations concerning ´if´ information technology is important for the nation and the society. The bill states quite explicitly that information technology is *the* issue, which will lead the nation to welfare and among the leading nations.

Theme number 2 The loving and caring state

The bill very strongly reflects, reproduces and strengthens the idea of the state that takes care of its citizens, like parents who know what is best for their children. This has been the ruling social democratic ideology in Sweden since the Second World War and known as `folkhemmet´ [people's home]. The main character of this ´folkhemmet´-ideology has been to build up a strong welfare system that guarantees social benefits, such as child care, health care and school education, for every member of the society

The same societal hug is also warm and inclusive when the bill talks about the gaps between men and women, people living in urban surroundings and in sparsely populated areas, people with low incomes and the immigrants and the tendency of the specific groups to use information technology less than other groups of the society. (GB, p. 16)

The caring and loving state is changing

The traditional ideology of the Swedish welfare state is based on a view that regards citizens as a collective. Thereby also the services the state provides are based on an ideology not supporting individual choices. Another basic principle has been the idea of the strong state and the strong public sector. The actual bill still supports the basic ideologies of the welfare state but also contains signs of change. One of these perspective changes is putting the individual citizen in focus and by stressing the active role of citizens in developing the democratic functions of the state.

The citizenship is not anymore a question of being a passive receiver of the public services but demands both being responsible for one's own choices and activating one's own opinions, claims and wishes. What the citizen can do is to more directly control the functions, decisions and directions of the authorities. The bill also opens up space for other actors to enter the public sphere. The state invites private and commercial actors to co-operate and collaborate with the public sector actors.

Everybody and everywhere: invitation/straitjacket

The official governmental direction for the IT-politics includes eight main sectors where the goal is to promote economical growth, employment, regional development, democracy and justice, quality of life, gender equality and equality in general, an effective public sector and a sustainable society. (GB, p. 26). These inclusive thoughts integrated with the idea of the loving and caring state can be interpreted, at least, in two contradictory ways. Either this bill is an honest invitation to all of us to join the information society and realizing the overwhelming and totalitarian changes of the society. The content of the bill can as well be understood that you are included, either you will or not, there is no place for resistance or hesitation. You are in; do not ask any questions. The bill describes information technology both as a technical and socio-political straitjacket, can be claimed.

Keylines

The government bill implies a strong IT-discourse. It is strong because it is a hybrid. It is a hybrid because it, in a very fuzzy manner, blends technology and society. Many of the citizens feel included, because there seems to be space for a wide audience. The IT-discourse as presented in the government bill is strong also because it mixes or integrates pieces from other strong discourses of the Swedish society. It combines the dominating gender equality discourse, the ´folkhem´- discourse, the new market economy discourse, the official environmental discourse and finally, the dominating discourse of technology that regards technology as the key factor for the prosperity of the societies.

Arena B Local politics

The 31st of May year 2000 the local council in a medium sized Swedish town accepted a document with the title ´The IT-vision for the municipality´ (ITV later on in this text).

The good town

There is a strong focus on developing a municipality attractive both for its citizens and its industries. In the good town the focus is on the citizens. The story told by the IT-vision sounds like this: ´The municipality is ´open´. Its services are easy to access and the accessibility is not dependent on time or space. The municipality wants to communicate with its citizens and will listen to and study their opinions. The municipality is attractive also for its industries; a well-equipped infrastructure will act as a tempting factor. The town is a good place for everybody to live in; it will take care of the disabled and the women. The good town is inhabited by its active citizens. All partners, the municipality, the industries, the educational system, have reached a mutual agreement when talking about the importance of information technology for the future development.´ (ITV, pp. 1-17).

The effective town

Beyond the construction of the good and attractive town to live and work in, lie other threads. Information technology demands or opens up possibilities to efficiency, control, steering and following-up. These thoughts can be found both when the vision document translates the visions to everyday organisational practices and when it talks about the development of the good town. The document refreshes the ideas and visions from 1970s of automatisation and computerisation connected to rationalisation and efficiency. [6] The document aims to develop clear goals for the administrative practices by introducing ideas of documented goals, control points, and steering. A digitalised version of taylorism, perhaps.

Keylines

When comparing the government bill with this municipal document it is quite apparent that they talk the same language. Both stress the further development of the Swedish welfare society based on the loving and caring public sector. Both documents also make it explicit that the welfare society is changing. The public sector will demand active citizens in the future. Citizens, who know what they want regarding public services. In this process information technology will be one of the main channels for the interaction and communication between the public sector and the citizens. Information technology will also be the space where the public services designed for the active citizens will be available.

The municipal document articulates high hopes concerning the development of the future promising a good living environment, deepened democracy and an equal society. These visions are not new; they have been the central part of the governing ideology of the Swedish version of the welfare state. What is new is that these ideas are embedded in a new technology.

Neither is the idea of the efficient and cost-effective administration new, not even when talking about how computerisation can be the key factor to save money and time. What might be new is that the dreams of the cost-and time efficiency are embedded in and motivated by the dreams of the increased service level of the public sector and an active citizenship.

Arena A Local Practices

I have interviewed one of the persons working with the IT-development in the same municipality where the vision document, I discussed in the previous chapter, was written and published. The person I discussed with is working with the development of the web site of the municipality.

People

The most central issue in John´s web talk is actually people and the existing and non-existing co-operation between them. What this indicates is that he puts a great value and importance on the human relations involved in everyday IT-work. In John´s talk a number of people with different positions and attitudes are mixed. He presents different categories of people involved in one or another way in the web production.

First, there are the enthusiasts who have visions and who initiate and encourage to find new solutions both concerning pure technical questions, such as software and database structures, and also organisational changes. The real enthusiast in this specific case is characterised by John, as follows: “He had competency of both IT and the organisational development. He had sketched how to tear down the borders. How to pee into the administrative borders. A tool to tear down the borders.”

According to John behind the enthusiasts there are the persons who criticise and at least do not actively give support to the ideas of the visionaries. In this actual case it is often the politicians who take this role. John says that: "Yes they [the politicians] do care. But they care afterwards. When they are not satisfied they care. But they do not care in before hand."

To the same group belong the persons inside the organisation who are, for one or another reason, uninterested, and who therefore might become the slow downers, or as John puts it: "There is a push inside the organisation at the same time when there is resistance in other parts of the organisation."

Somewhere in the middle of the two groups there is the group of people we might call cleaners or fixers. They are the ones who try to pick up the pieces when there is lack of money, delays of software deliveries, and uncommitted fellow workers: "[John has been talking about the passed deadlines and complicated situations both considering persons and software when he starts to talk about one particular person] who had to jump in and take responsibilities towards politicians…so he had to jump in and take care of keeping the project alive and seeing that it´s functioning and that it develops and goes on…"

And John adds: "I was given four weeks to find a new publishing system and to be responsible for the installation. It was impossible, actually….She [now he talks about a woman employed at the municipality] worked like a dog, night and day."

The boundary object

John´s story is a story about frictions, what happens when the partners involved, by negotiating, cannot agree upon a web site that is ´enough of the same´ for everybody. Bowker and Star use the concept of boundary object and write: "boundary objects are objects that both inhabit several communities of practice and satisfy the informational requirements of each of them. " [7] The shared common agreement could support the further decision making and web development in the everyday practices. John explicitly says that: "They…have a picture. We working in the reality have another picture. Those pictures have never met."

The following negotiating partners are involved in John's talk: the structure and the content of the web: "For example, what will we have for menus and who is allowed to be there and to be visible…There was a fundamental shortcoming in the structure from the beginning. Namely, that we had used the administrative structure of the municipality as the starting point [on the website]…There were many roundabouts. The structure was re-designed. There was an internal dissatisfaction: ´People don´t find me….and so on and so on…. Never ending discussions."

Another negotiating partner is the visionary ideas of the Internet understood as a place for democratic dialogue and an all day open service provider: "We don´t have any money to develop the 24hours authority [= the official Swedish term for providing electronic public services for citizens], to provide interactive services, such as queuing for the child care place. ..The Place for Democracy…we don´t have any money to do something…"

The third negotiating partner is technology, both presented by the software companies and the software. Citing John: "We had to find a tool that supported our thoughts [of a decentralised version of updating the web site]. There wasn´t anything that was ready….And then we found a local company who had an embryo. It was far away from the final version and it was not designed for the public sector. It was a dialogue. We were in and developed. We had requirements regarding the interface and the functions…Later on Nick [the visionary] started to consider the possibility to put the Internet and the intranet together with a publishing system. To build up one single platform. There were no tools that supported these kinds of ideas. Then we again found a company that had an embryo. They [=the company] painted pictures, but it wasn´t ready. But it supported our idea of functionality and the way of working. .. It was cool. It was what we were looking for….But they couldn´t deliver. There was no functionality."

Time

Time is an issue in John´s talk. On one hand he refers to the municipal idea of being many steps ahead others, but he states quite sarcastic that "instead of being years before others we actually are many years after." Here his time line contradicts the visionary words of being out first and being best as identified and recognised in the vision document.

John is very occupied by action plans, delivery times, and deadlines in general. This is of course part of the time ideology connected to information technology. But where the official information technology time is rapid, fast and non-problematic, in John´s talk time becomes an obstacle, a friction, a huge problem, which he and his fellow workers have to work with and fight against. There is also the time before, the period of ideas and realization, and the time afterwards, when things do not work as they were planned and when the criticism starts to get articulated.

Keylines

John is one of the persons at the grass root level whose task is to translate the IT-visions to reality and functional services. What John´s talk indicates is that the translation work is not only to adopt the computer based tools and installing hardware and software. The core in his talk is about various kinds of ´meetings´: the old organisation and routines try to meet new ways of working and to transgress the existing organisational borders. People meet software. The employees meet politicians. Everyday meets visions.

And so on. John´s talk leads us back to the description in the government bill saying that: ”It is important to understand that IT and information society is not only an integration of computers, media technology and telecommunication systems in a narrow technical sense, but also a sociotechnical system where the different forms of ownership, organisation and the regulative system in a high degree determines the development. “ (GB, p. 14) and where John would add ´human relations, negotiations, contradictions, friction…´

Discussion

It seems that the arena C is stable in the meaning that the space for negotiations is closed. There is at least one reasonable explanation to this. At the moment when a discourse reaches the stage of articulation and publication, as in my example the government bill, it is getting closed and the period of negotiations is over. The government bill is both a product of the dominating IT-discourse in Sweden and it keeps on re-producing and strengthening it. One clear indication of the strength of the dominating discourse is that it is not only produced and re-produced at the national level, but as explicitly and synonymously at the municipal level, as in my case study.

When we move to the grass root level, the arena A, the ingredients of the story are changing. The processes and practices are getting messy, heterogeneous, and thereby complex. If the arenas B and C could be described as stable so it is instability that describes the story told by John, the local web developer. In the everyday work both of stability and instability co-exist. The web site of the municipality gets done and is being updated. Beyond this functioning stabile layer there are a lot of actors and their mutual on going negotiations making the stability shaky and vulnerable. [8]

This is exactly what the web production in this municipal organisation is all about. How to reach the stability when there are so many unstable elements involved? Many of the elements that John has identified are for the official web process more or less invisible, because they are not considered as the core account of the local information technology activities and processes. The elements of time, soft ware, politics are only ´present by being absent.´

What is obvious after reading the texts and interviewing John, is that designing information technology (in my case dressed as web production) is much more than designing the web site. The heterogeneous actors design not only the the municipal society during their implicit and explicit negotiations, but they also design the society, the municipality, the organisational relations, boundaries between the public and private sector, the relations between the citizens and the administrations, and their work. This perhaps helps us to understand the complexity of the everyday life of information technology, but a question still remains. How to bring the different elements more explicitly to design processes? Or is there a risk that we will get lost in a jungle of too many actors, negotiations and networks and thereby loosing the focus of the participatory design?

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A participatory design approach for the development of support environments in eGovernment services to citizens

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ABSTRACT

The introduction of eGovernment services and applications leads to major changes in the structure and operation of public administrations. In this paper we describe the work in progress in an Italian project called "SPO.T." aimed at the analysis, development, deployment and evaluation of tools and environments to support the people who plan, deliver, use and evaluate user-centred provision of One-Stop-Shop services to citizens. The "SPO.T." project has focused on two requirements: 1. the support tools and environments must facilitate the active involvement of all stakeholders in the definition and evolution of eGovernment applications and services, and it is argued that through participatory design changes of structure, process and culture can be delivered effectively; 2. they must embody a set of architecturally coherent resources which reflect the new roles and relationships of public administration and which are sufficiently generic to be relevant to a wide range of local contexts across the community.

Keywords

eGovernment services, Support tools and environments, Design in use.

INTRODUCTION

The area of eGovernment is one of rapid change where services are modernised and integrated. It is clear that such integration is not imposed from the outside or from above, but is generated from within the working contexts of service development planning and delivery. The most important dimension of change in the new concept of public service involves the breaking down of barriers between departments and units, the negotiation and implementation of multi-disciplinary and multi-agency networks and protocols and in more efficient and effective communication, transaction and co-ordination.

Thus, the individuals who are responsible for the planning and delivery of public service respond to new policies, targets and priorities through a process of co-design and reconfiguration of their own working environments and relationships [1].

The maturity of eGovernment developments

The first stages in the development of eGovernment applications and the exploitation of new channels and media in the delivery of public and administrative services consists of little more than the creation of web sites which may inform about service availability and qualification but do not provide access. This, initial stage, however, soon generates issues of editorial control, maintenance and co-ordination. Furthermore, the issues of portals, which provide the electronic equivalent of a single point of access to information, emerge. Since such developments are often

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accompanied by the development of physical one-stop-shops, we often observe a parallel development on the intra-net of the call centre support functions with the internet and kiosk development of public access.

These, first generation applications generate a requirement to go beyond simple form handling and the introduction of electronic transactions. We see in these first instances of the introduction of the new channels and media a requirement for more fundamental change in administration processes and, indeed, the legal context in which they are delivered: electronic signatures and messages have, for example, to be acceptable as legal instruments. This leads to second generation eGovernment applications that provide integration and intermediation of service publicity together with support the transactions associated with service access and some aspects of delivery.

A characteristic of the first two generations of applications is that their technical provision and delivery can be achieved through quite conventional means: requirements can be defined, implementers can design and develop prototypes which can be deployed and evaluated in the field. This is because they represent the re-implementation of existing, well understood processes. However, such applications themselves start to create new demands and opportunities for restructuring the administration processes themselves. Our experience in the survey and analysis of eGovernment applications across Europe indicates that an important transition takes place at this stage and the conventional, waterfall oriented development lifecycle models become problematic. This is because the third generation applications are constructed in the context of significant changes at the organisational and policy levels and the full and effective participation of all stakeholders in these processes is critical for their success. (It is at this stage that the need for new sorts of partnerships between different sorts of public and private organisation emerge in the development and delivery of eGovernment services through new channels and media. The old, arms length procurement relationship is not necessarily appropriate in this context.)

Such participation requires appropriate technical means as well as the commitment of all the participants. Technologies such as work-flow and XML forms and proprietary products such as LOTUS Notes have been adapted and adopted to provide a concrete medium round which administration staff from different departments and functions can make their explorations and negotiations of new ways of working explicit in a similar way in which, in the past, they have worked with paper forms and pictures of organisation charts and process flows as a medium for co-design.

If eGovernment applications are to make this critical transition to the third generation, then the stakeholders must be enfranchised and empowered, they must be given the technical means to participate in co-definition and co-design processes of both the organisational and the technical systems.

This work-in-progress paper reports first experiences from a project in Italy in cooperation with the Public Administration of Trento. However, the research and development methodology has been developed for a joint EU application with Blekinge Institute of Technology and Ronneby municipality, and Newcastle University and Newcastle municipality. Our work in Trento is informed by ongoing research in all three sites in cooperation between the respective university and municipality. First results from the project in Ronneby are also presented in a separate submission to PDC2002 [2]

THE SPO.T. PROJECT

It is within this framework, that the project of the design, development, deployment and monitoring of a One Stop Shop (OSS) for services to enterprises and citizens in the Province of Trento, located in Northern Italy is taking shape under the code name *"SPOrtello Trentino per le attività produttive"* (SPO.T.).

The local government Provincia Autonoma di Trento (PAT) is fully committed politically in improving services offered to citizens and companies, adopting advanced technologies based on the Internet. Significant investments have been provided to support the Department for Information Services and the Department of Organization in this effort.

The PAT wants to develop an integrated, one-stop approach to accessing public services from the user's perspective. It will provide a range of access mechanisms and channels that meet the requirements of citizens when, where and how they want it, and make financial and other key public transactions easier and more secure. The implementation of the SPO.T. project aims to a more effective use of information and resources, both internally within the Public Administration (PA) and with partner organisations. To achieve the vision of eGovernment the PAT is developing an infrastructure broad band network connecting its offices distributed in the region as well as users in remote and rural areas (the Province of Trento is a region with mixed mountain and urban areas).

In the first phase of the project the provided services will address a subset of the most relevant administrative services identified at European and Italian level in the related eGovernment action plan [3]. They include procedures from all four Public Administration service categories identified at European level [3]:

- License services to provide various kind of authorization (building licences, starting of new activities etc..);

- Registration services to provide registration and information data for administrative procedures (identity, residency, stay permit etc..);
- Health and Welfare services;
- Income services: all interactions and transactions that include financial fluxes between citizen /enterprises and local public administration.

In order to fulfil these objectives PAT has established a working group that includes representative of all stake-holders involved in the process: internal organizational and IT managers, internal users, representative bodies of external users, an IT Consulting firm and the University of Trento. The mission of this working group is:

- to provide a feasibility study for the creation of physical and virtual One Stop Shop (OSS);
- to design and develop a first integrated software platform to support the people who plan, deliver services to citizens as well as the users of OSS services;
- to deploy the proposed platform in a subset of local administrations for a certain number of procedures (municipalities with more than 3000 residents)
- to monitor and analyse the results in order to support the growth and emergence of third generation eGoverment applications as well as to evolve the system to all municipalities and procedures.

Each participant in the working group is representative of specific stake-holder explicit as well as hidden goals, that need to be considered for the success of the overall project:

- Public Administration internal organizational and IT managers, are enforcing the overall commitment of the local government with the explicit goals of improving the level of services to citizens, internal efficiency and overall economic savings. Hidden goals are mainly of a political nature: enlarging consensus etc..
- The Public Administration internal users will bring their expert point of view in order to secure the successful use of the proposed supporting tools. Hidden goals are mainly of a social/syndicate nature: to be involved in the redefinition of human resources profile and allocation.
- The representatives of external users, such as Chambers of Commerce and Association of Citizen, will provide the necessary insights of the specific needs and requests from the final user of the OSS as well as their evaluation of the supporting tools devoted to the use of the services. Hidden goals are of a social-economic nature: improved efficiency, cost effectiveness and transparency of the administrative procedures;
- The IT Consulting firm is participating to provide knowledge on IT issues and application and technological guidance in the development of the tools. Hidden goals are of a commercial nature: market share, alliances with national and international hardware and software providers, re-use of developed solutions etc..
- The University has been asked to join the group to provide methodological guidance in the design and development phase and to assist in the organizational change management issues during deployment. Hidden goals are of academic nature: research opportunities, funding opportunities etc..

To understand and integrate all these different explicit and hidden goals in order to achieve a successful deployment of One Stop Shop services and supporting tools is one of the major challenges to the project.

In the first phase of the project the focus of the working group has been in the agreement of a shared methodological approach to be used. A consensus has been reached to first study the administrative procedure as they are performed at the present, to understand the difficulties and develop ideas how methodological elements from architectural discourse and use oriented and participative design, can support the project. Based on the experience with the deployment of these methodological elements, we will develop a first version of the tools and deploy it within a limited number of pilot procedures. The dynamic observation of this deployment will allow us to improve the tools into subsequent phases of the project.

From a social science point of view, the project methodology can be described as researched development. Researchers accompany service and software development practices and reflect their results back to the practitioners and through that support the ongoing pilot projects. From a computer science point of view, the project methodology implements a process for iterative method and tool development [4] , using the experience with the deployment of prototypical elements and early version of the method and framework to improve the final outcome.

EMERGING ISSUES

In the present section the main ideas that are shaping the definition of possible solution for the SPO.T. project will be briefly presented. They comprise architectural, participatory design and IT issues as they are emerging in the extended group of research institutions mentioned in the introductory section.

Intermediation and brokerage: the architectural idea

The development of the first generations of eCommerce as well as eGovernment applications [5] has emphasised concepts such as the front and back office co-ordination with the call centre and the One-Stop-Shop as means of integration for users. In the context of social, clinical and welfare services, concepts of the communities of practice and managed service networks have also become important.

Finally, responsibilities for service commissioning, planning and provisioning are no longer seen as separated from those of delivery and evaluation but as integrated parts of the same quality loops and evaluations which must encompass and involve clients and users as well as providers and deliverers.

The concepts of intermediation and brokerage provide an extremely powerful abstraction for exploring changes in the way service relationships are understood. In its most general formulation a proposed intermediation and brokerage architecture [5] identifies four (abstract) stages or epochs defined in terms of responsibilities and relationships. These should not be interpreted as a process sequence but as highly interacting and parallel. They are:

Formation where the set of available resources, capabilities and service offers are identified, recruited, assembled, organised and presented. Here we see the requirement for registration classification and validation resources and capabilities are co-ordinated around the generic concept of the catalogue.

Rendezvous where specific relationships between elements of supply and instances of demand are identified and selected. Here decision support and knowledge management resources are brought together with records and histories. The issues at stake are whether this combination of services and functions is an appropriate and available response to the needs of the client and whether the client qualifies for them. At the level of populations, this becomes a question of whether we have the appropriate range of services which combine to meet the expected needs according to the prevailing policies and targets.

Transaction is concerned with the activation and supervision of delivery which may be distributed over both time and space. Case management resources and capabilities figure in this epoch of intermediation.

Post-transaction and evaluation closes the service loop providing the basis for quality management, failure analysis and recovery and the potential for organisational learning.

This description of intermediation is, necessarily abstract. It is used in the following ways: firstly, it provides a conceptual framework for service integration and delivery – the front office and the one-stop-shop are brokerage environments. Secondly, it provides a framework for co-operative work and mutual support in communities of practice where public administration, social, clinical and other care professionals intermediate their own skills to each other in the construction of multi-disciplinary and cross department client and citizen oriented plans at both the individual level and as guides of policy and good practice. Finally, it provides the basis for a more flexible and responsive approach to service planning and management where the ever changing needs for information about performance, effectiveness, demand and opportunities are themselves satisfied through information intermediation and brokerage processes rather than by the redesign and implementation of specific management information systems with each new demand. Current approaches to this capability tend to assume monolithic organisation and rely on the concepts of the “data warehouse” and of “data mining”. While these have a place in some current eGovernment implementations, the more generalised solution of highly distributed and federal information environments emerge from the more generic notions of brokerage we are developing here.

As has been indicated in the definition of brokerage epochs, the abstract concepts map onto a number of quite familiar tools and methods: these include the catalogues, client records and case management, decision support and guidelines, quality systems and knowledge management tools. At a level below, these user oriented applications concepts are a further set of quite well known platform or middle-ware concepts such as workflow and distributed transaction services, security services which provide authentication, signature, non-repudiation, directory, audit and so on.

Thus, we propose to construct a cogent set of links ranging from a very abstract set of concepts to more concrete and specific ones. The generic concepts must be powerful enough to provide a useful conceptualisation of the organisational changes implied by third generation eGovernment applications across the wide range of political and cultural contexts. The concrete ones must be sufficiently accessible to provide a basis for the participative exploration and co-design of new administration processes and practices.

These implementation concepts are under consideration within our pilot environment. We aim to provide a coherent architectural framework so that incremental developments and progressive levels of co-operation between different administration departments and agencies can be reliably positioned in longer term strategies and that appropriate and effective links can be made between different levels and domains of administration.

Use Oriented and Participatory Design

As network technologies like internet-intranet-extranet are used more and more to provide governmental services, the interaction and mutual dependency of the design of services and the supporting eGoverment application become more and more visible. The re-development and the integration of the services, that becomes necessary with the introduction of computer support, provide a challenge in itself. Different professional cultures and practices of service provision of different departments have to be related to each other. The work practices in the departments have to change when a common infrastructure is to be used.

Such re-design of services and provision of services can only be achieved with the participation of the practitioners involved. The architectural design concepts therefore have to be complemented by methods, mediating representations and tools that allow for the anticipation and discussion of and commitment to the embedment of the supporting infrastructure in the work practices and the related organisational changes.

Participatory Design and methods [6] can be deployed to mediate between the architectural concepts and elements and the concrete practices of service provision. The methods, tools and the principles regarding organisation of projects have been successfully applied in research as well as industrial projects mainly in Northern Europe [7]. Experiences with complex IT infrastructures for heterogeneous user groups, like hospital information systems, have been reported [8]. The following parts have been identified as key ingredients in the overall methodology:

Design workshops between developers and users [9] addressing the future organisation of work as well as the concrete design of the computer application on as equal terms as possible. The future users as domain experts provide an important resource for the design process.

The usage of concrete representations like rich pictures, mock-ups and prototypes as boundary objects between developers and users: using ordinary language and easily understood representations allows the development of a foundation for co-operation that is highly relevant for the design of usable software.

An iterative and evolutionary approach [10] allowing for feed back and learning as the impact of re-organisation and changes in the work practices and their interaction with technical features of the software under development can not be anticipated in the same way as the design of a computer application.

The participative approach together with the architectural discourse applied in this project is in our opinion a sustainable support for the development of a platform in public service provision for enhanced co-operation, coordination and integration of services and the continued design in use of services and IT infrastructure.

An important issue that remains open and that we wish to address in the project is how to use the methodologies and experiences of participatory design developed in Northern Europe in the Italian Public Administration environment This translation process will involve cultural, technological as well as social issues that will be investigated.

ITC Supporting environments

One of the objective of the SPO.T. project is to develop a general platform for ICT supporting tools to the OSS operations, which may be adapted for use in an extended range of administration contexts and stages of the local eGovernment maturity. This will also be achieved in the form of XML schema and object oriented computation projections as a framework for the generic solution for supporting systems in eGovernment services. There could be many solutions which are acceptable to Public Administrations who intend to engage in eGovernment services: it will be a requirement on these schema and projections that they exhibit a wide range of configurability and composability. The concept of object oriented computation projection provide a powerful abstraction for exploring this solution space. An initial proposed configuration includes four major computational components each of which comprises a small number of sub-components. They are:

Catalogue environment: the organization and presentation in a catalogue of services and information within a Public Administration. This collection and organization of such information is also central to the concept of brokerage. Tools like Web sites, innovative portals and distributed databases lie within this domain.

Transaction Environment: the purpose of the transaction service is to ensure that, once a service is requested by a specific customer, all the required pre-conditions are met before commitment and that all post-conditions are achieved after commitment. Middle-ware concepts and tools such as workflow and distributed transaction services, security services populates this environment

Decision Support Environment and **Case Management Environment:** Public Administration face an ever-growing amount of information management to enable them to provide services to citizen and enterprises. Tools like Decision Support Systems and Case Management Repositories based also on the previous catalogue and transaction environments can supply a more comprehensive overview and enable more efficient access to the range of services provided across different parts of the organisation.

All ITC tools of the proposed framework will be utilized by two main categories of users: (1) operators in physical OSS to assist them in their service provision and (2) citizens and enterprise personnel to assist them in the navigation and utilization of virtual on-line OSS services.

CONCLUSIONS

In the SPO.T. project we believe that a participatory approach together with the architectural discourse proposed in the project will support the development of a platform in public service provision for enhanced co-operation, coordination and integration of services as well as the continued design in use of services and IT infrastructures.

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Dynamic Interactive Scenario Creation: a method for extending Participatory Design to large system development projects

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ABSTRACT

Basing our findings on experience from a participatory system development process in the Swedish project Distance Supported Learning for Local Knowledge Needs (DLK) we present and discuss the DISC-method for participatory scenario creation. We argue that, in large and distributed Participatory Design projects, the method can be suitable to aid participant selection and create a shared understanding of the current situation while preserving the democratic and multi-disciplinary character of Participatory Design.

Keywords

Participatory Design, Scenarios, Methods, Organisation analysis

INTRODUCTION

In large projects involving complex organisations, user acceptance of the final system design is often the critical factor for system success. In order to develop a computer system that is efficient, it is today therefore widely accepted that it is necessary to perform a thorough analysis of users, tasks, infrastructure and interaction within the organisation when the system is designed. From this perspective, Participatory Design (PD) methods appear as suitable for creating a successful design solution also in these settings. From the late seventies a number of specific design methods based on involvement of participants from the goal organisation in a small-group process have been created. The design activities can range from organisation and task analyses in the early phases, through different methods for cooperative prototyping, to the late phases of evaluation and customisation. Because the suitability of the various methods differs according to for instance, user characteristics or the type and size of organisation and project, it has been found beneficial to have a toolbox of methods to choose from. This stance is used in Action Design [9] for instance.

Problem formulation

As is the case with most PD methods, Action Design was originally adapted to projects where the intended user group is relatively small and geographically concentrated, e.g. at hospitals or in school districts. This was known when the method was introduced in a project where the goal was to design a system that would primarily suit 225,000 users, spread over 18 different affiliations in a nation-wide third sector organisation. Some of the twelve members of the basic PD-group lived and worked more than 200 km away from the venue for the group meeting. To reduce travel time, fewer and longer meetings were scheduled, four- or five-hours long, instead of the two-hour meetings suggested by the Action Design method.

During the project, the majority of the participants were also working at least part time in their ordinary work beside their organisational assignments, which meant that synchronisation of the design group meetings was complicated and group meeting attendance suffered.

A relatively long period of group work combined with the turnover in assignment was another complicating factor because some group members left the PD group early and replacements entered a group where the rules and knowledge had to be re-established.

Combined with the problem of geographical separation, the size and diversity of the intended user group lead to a problem with group member representativeness and selection. The number of different affiliations and

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assignments made it impossible for every stakeholder to participate. In the project, participation by those who were active in the region and were members of the most active affiliations was prioritised. Furthermore, project management members were prioritised for power reasons, as were members with key competence, such as Human-Computer Interaction, pedagogy, and system development.

The approach selected for the project was to form a design group with the prioritised users and using survey methods to gather information about users outside the design group thereby bringing the perspectives of external users into the discussions [8]. Based on the findings in the project, the Dynamic Interactive Scenario Creation-method (DISC) was designed as a means to overcome the aforementioned difficulties and to create a closer connection between meetings and the day to day work activities.

Study aim

The aim of this study is to describe a method for scenario creation that can act as a design memory in large PD projects. The intention is that the method should facilitate extra-meeting interaction between geographically dispersed group members, while preserving the democratic and multi-disciplinary character of PD. The method is mainly to be used early in a project to create scenarios on which to base design work but also the method should be used for the evaluation of prototypes.

Theoretical background

In most design projects, a comprehensive knowledge of the users, context and tasks, is of key importance for a successful design. As an aid to better understand use environments, scenarios reflecting the current conditions have been used for various purposes throughout the design cycle. It is claimed that these scenarios make users tasks and the situation of use more concrete, i.e. they are supposed to "help developers and users pose new questions, question new answers, open up possibilities" [2]. The scenarios can be based on multiple sources, such as interviews, observations, and methods for diary keeping. Scenario development can be employed in the early stages of a project for task- and requirements analysis and functions as a means to create a shared understanding of the present and intended use between participants in a design group. In the later phases, scenarios can be useful tools for structuring the functionality provided in the system and for evaluating prototype solutions [2]. For a long time now, scenarios have also been used in combination with prototypes to make concrete the present or future situation of use.

In participatory design, the experts on context, users and tasks are in the design team. Their knowledge however, is often fragmentary since the division of work as well as different work roles make each user an expert on a subset of the activities within the organisation. Users' knowledge can be divided into four types: Declarative, semantic, procedural and episodic [6]. To some extent, the knowledge is tacit since *acting in* the role does not always imply *reflecting about* the role. In participatory design projects, "high level"-scenarios, spanning over different users and focusing on the relations between users, goals, procedures, and tools can act as concrete descriptions that form a baseline for further design. It has been argued that participatory design projects tend to focus on the system development process rather than on the earlier and more analytical understanding of the current situation [3].

METHODS

Action-research methods were used for the study that was performed in the Swedish Distance Supported Learning for Local Knowledge Needs (DLK) project, which started in 1997 with the aim of supporting shop-stewards in their roles as union representatives. As a part of the project, a design group was formed in 1999 to investigate how IT-solutions may provide support for shop-stewards' needs for education, information, and communication among shop-stewards themselves as well as between shop-stewards and higher levels of the organisation. The work was led by members of the MDA research-group (*People, Computers and Work)* at Linköping University, and was based on a set of participatory methods and tools in the Action-Design method developed within the research group. Apart from members of *MDA*, the group consisted of local representatives from different unions in Linköping, members of the DLK-project management group and one educationalist from the VuxCen group at Linköping University. In all, 20 four- or five-hour long design meetings were held between October 1999 and October 2001, when the work was concluded. Between six and twelve members were actively engaged in the group work during this period.

During the design meetings, all participants were actively engaged in open and constructive discussions. Between the meetings, the group was scattered and responsibility for the group work was tacitly given to the members of *MDA*. Despite our best efforts to break this pattern by giving group members "homework", the issue of between-meeting passivity was not satisfactorily resolved.

The Action Design group worked with scenarios that were initially created from replies to a questionnaire based on the Critical Incident Method [5]. These scenarios were used for the evaluation of a mock-up prototype. Based on the results of the evaluation, the scenario format was revised and used when a Future Workshop, spanning over three consecutive meetings, was organised within the design group. The scenarios were used for input into the design process. Finally, following another revision, the scenario format was used to assess the design to see whether the system would provide support in highly demanding situations, as a contrast to the mainstream use situations that was the focus of the Future workshop.

RESULTS

The aim of the DISC-method is to be a tool that can be used in early phases of a PD-project as a means to generate and structure knowledge about tasks and cooperation in an organisation. The scenarios are intended to be lightweight in the sense that the descriptions may not be complete and elaborated. We consider it more important to have a broad set of less elaborated scenarios than fewer and more comprehensive ones. If entering scenarios is laborious, users will hesitate to take that extra time, especially in a stressful situation. We would thereby run the risk of missing some of the most critical situations of use.

Purpose

The purpose of the method is to assemble and analyse, in a PD group, knowledge about the day-to-day information flow and tasks in a large user organisation.

Prerequisites

The majority of prerequisites that need to be fulfilled in order for the method to work originate in the PD context. Before the DISC-method is used, a group consisting of representatives of known stakeholders in the project has to be formed. They will form the initial group that may later be expanded as the work progresses. The first meetings in the PD group are devoted to group forming and introducing the project. The Action Design method used in the DLK-project prescribes that an *internal group contract* be established and signed by all group members. This contract regulates meeting- and group interaction rules to ensure that everyone has the same possibility to influence the work and to prevent the possibility of later conflicts. In our experience, the creation of an internal group contract is valuable to later group work. When using the DISC-method, it is also important to stress that the scenarios written down will not be disclosed to persons outside the group. The method is presented and exemplified at one of the early meetings and users may enter test scenarios and ask questions to get used to the technique.

Participant instruction

Each participant in a DISC group is given the task of observing their work. They are instructed to observe their daily work practices that require communication either with present computer systems or colleagues and report on situations that are particular, problematic, stressful or time consuming. Based on the fact that the work context provides memory cues, the tasks the user currently works with will sometimes remind them of previous problematic tasks. If the participants regarded these tasks important in their work, they are encouraged to create scenario descriptions also for those earlier events. They are instructed to keep scenario descriptions brief initially in order for them not to interfere too much with their ordinary work.

Primary scenarios

When important events occur, the participant uses a special Scenario Form to create a *primary scenario description*. The Scenario Form contains fields to fill out descriptions on:

- What action the scenario addresses, e.g. to look for specific information or write a protocol.
- When these kind of activities are performed. Evenly spread out over the day/week/month/year or more often at some specific time.
- The event that triggered the need for the user to act.
- How often these activities are performed and how long time they take. What percentage of the total work hours these actions do consume.
- Where and in what situations these actions are performed.
- What results are sought, and when the results need to be achieved.
- Who and what the subjects are dependent on in order to fulfil their goals. With whom they need to communicate and what kind of information they need.
- What information is communicated to colleagues and what information is expected in return.
- Which media that are used to communicate with colleagues.
- How important it is that the task is completed.
- How often the initial attempt to solve the problem fails and if there are alternative strategies.
- If the user could wish for an ideal solution to the problems he or she faces, what would that be?

Secondary scenarios

A secondary scenario is the result of a design group member creating a scenario that at some stage involves another member of the design group. The member can be mentioned in the primary scenario form either as a trigger of the action in the primary scenario or as a result of the action in the scenario. If, for instance a group member (B) gets a mail from a person (A) asking for information or requires an action of a person (C), the scenario can be traced backwards (What triggered A to send the mail to B?) and forwards (What is needed from C to make it possible for B to act on A's request?). The primary scenario descriptions will thus be forwarded to A and C who add *secondary scenario descriptions* and thereby add and connect descriptions of their actions to the primary description. This action is recursive in the sense that the secondary scenario descriptions may in turn reveal involvement from other persons who might expand the scenario descriptions further. The scenario descriptions are linked to each other rather than directly attached. When C receives the scenario description from B, A may already have entered a secondary description that is thus accessible through a link.

Design group restructuring

The Scenario Form is submitted to a design-coordinating group. This group consists of members from the Action Design group. They gather and analyse the cases to see how information and collaboration in the organisation is distributed. When scenario descriptions contain information saying that their peers are to be contacted for information or action, the description is transferred to them if they are members of the design group. Otherwise, Action Design-group members with similar roles in the organisation receive the message. As the process evolves and more scenario descriptions are submitted, it might be obvious that important roles in the organisation are not represented in the Action Design group. The group may then be extended and cases which had previously not been sent on, may now be transferred to the new group member.

It is likely that an uneven distribution of cases will be sent to different members of the Action Design group. For group members with the highest amount of traffic, the design-coordinating group may then limit the number of cases received by that person, to the most important cases. Members who seldom partake in scenario creation or refinement could be encouraged to write more.

Meeting located activities

The design group meets and analyses on a regular basis what way in which the present practices and tools may be improved to better fulfil the aims of the organisation. At meetings, members of the design group can analyse and group the created scenarios. Related scenarios can be linked together. Lo-Fi prototypes can be designed and later be implemented as web-based prototypes for the participants to use in cases where the computer has a central role in the interaction.

Paper-based variation

In some projects, the participants may not yet have access to a computer system and a simpler method with paper based forms for entering the scenario descriptions has to be used. The user provides the same information as in the computerised version but the scenarios have to be exchanged manually between users. That makes the paper-based variation inconvenient for use with distributed work groups. Linking and viewing different scenario descriptions is also rather more difficult than in the computerised version. The general idea is, however, still to dynamically create and expand scenarios in order to obtain a shared understanding of the current practice and aid the prototype design.

Method suitability for projects

As the DISC-method is based on our findings in the DLK-project it is primarily suited for projects similar to this one. It is thus designed to be used in projects where group members are geographically separated to an extent that makes frequent meetings and observer based scenario capture cumbersome.

The method is probably best suited for large and complex organisations where a structured method for scenario creation can motivate the overhead effort of a formalised method.

Although Participatory Design can be used to create a wide variety of artefacts, the DISC-method is designed mainly for the creation of multi-user computer systems to aid cooperation and communication in professional organisations.

With the computer-based method it is a clear advantage if group members already have easy access to computers where the resulting system is intended to be used.

DISCUSSION

The method is called *Dynamic* for two reasons: The scenario creation is dynamic because it begins with one user writing a primary scenario description that is sent on to other users that add descriptions of their own actions, taken earlier or later in the causal chain of events, to the scenario.

The second reason refers to the dynamism regarding what users that participate in the scenario creation. If written scenario descriptions show that information or action is needed from people with a role that is not represented in the design group, their perspective may have significance for the usability of the final design. If that information is of enough importance, they could be enrolled in the group as full members or otherwise may just help the Action Design group complete the scenarios and later evaluate prototypes based on those scenarios. In such a case, it is also important to stress that all descriptions are intended for use exclusively within the design group.

We labelled the method *Interactive* because the creation of scenarios involves a relatively high degree of communication between the members of the design group. Interaction also focuses on how different users interact to fulfil a common goal.

Naturalistic scenarios

The descriptions in the Scenario Forms are likely to provide a more reliable view of the work content and information flow than a description made outside the work context, for instance at a design group meeting. The scenarios are, in a way which is very similar to scenarios created from ethnographically-created video material [1], anchored in current work practices and mediate the exploration of future situations of use.

The method gives clear indications of whether important stakeholders are missing from the design work. When Case Forms state that information is sent to or needed from actors outside of the group, it is easy to temporarily or permanently expand the group that use the DISC-system.

The system automatically provides documentation of relevant scenarios that later can be used in other participatory distance-adapted methods such as TelePICTIVE [7] in the later design and evaluation of the system.

As users in the forwarded scenarios read descriptions created by other group members, their understanding of their own role in the ability of other group members to fulfil their tasks, increases. When participants formulate their scenarios, they are also forced to reflect on how and to what extent they are dependent on the work of other participants. The scenarios can therefore help create a common understanding within the group. In design groups where different members are active at different times, structured scenarios can transfer design knowledge and rationale for design between members and over time[4].

Due to that the participants also can rate the importance of the tasks that they perform, these data can be used for analysing imbalances in the incentives and priorities of stakeholders.

The issue of contextual accuracy is methodologically interesting. To what extent do methods, performed outside the work or use setting, capture the demands and actions performed within the setting? Descriptions taken down "in situ" are likely to be more accurate since the context provides memory cues. Descriptions given during the action also eliminate the risk of hindsight bias. There are thus good reasons to believe that factual information in the scenarios provided by the DISC-method is more precise than corresponding scenarios given through decontextualised methods.

Weaknesses of the method

There is naturally some overhead effort in the method when activities that are of minor relevance to the design of a computer system are thoroughly documented.

Perhaps the most critical drawback is the fact that the extra effort of documenting work tasks is least performed when it is most needed. In periods of stress and for participants with a high workload, the registration of tasks is likely to suffer. There is also a risk that the registration of tasks will miss important activities that are not performed at the computer.

One of the cornerstones of Participatory Design is that all stakeholders should have the same possibility to influence the solutions they are designing. There is, however, always a risk that some perspectives may be lost and others become unduly prominent.

Due to that the method is based on written reports from workplace situations, perspectives from participants who are unsure of spelling and expressing things in writing may be lost. In many blue-collar professions as well as in some non-work settings, project participants may hesitate to enter text that can be kept and later referenced. This is to some extent the case for the shop-stewards in the DLK-project, who work in a culture that is more based on *oral and transitory* rather than *written and permanent* communication. This could possibly affect recruitment to the group and reduce the influence of the hesitant participants' perspectives. Due to that fact, and with a general wish to reduce the amount of text input, our choice is to keep the scenario descriptions brief.

Further studies

Present a method that has not yet been empirically validated can scientifically be seen as questionable. The method is, however, the result of our experience of where the difficulties can be found in running a participatory project with a large and distributed user group. Furthermore, we consider it to be of interest since the proposed method is relevant in the early phases of design projects, which have hitherto attracted less interest than the "downstream" activities: prototype creation, evaluation, and refinement. In other participatory design projects like the DLK-project we would definitely use the DISC-method in the early phases and we invite other researchers to use it as a tool or inspiration in the early phases of similar projects.

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A User-Oriented Approach to Building a Video Community in a Distributed Workplace

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ABSTRACT

In this paper we present experiences from a two-month pre-study on the possible creation of a communication environment (Media Space) between the three different locales of a distributed Call Centre. A spectrum of user-oriented methods was used in the study, and the staff at the Call Centre took part through interviews, discussions, and a workshop. The approach yielded useful information, and the feedback from the user group was very positive. Some pitfalls and risks were identified, such as technology focus, and to come up with solutions rather than to reflect on needs. A useful foundation was laid for the continuation of the project, which includes continued co-operative design work and the establishment of a communication environments in the workplaces.

Keywords

Video-mediated communication, distributed workplace, community, media space, design process, participatory design, video routing, fibre-link network

INTRODUCTION

In this paper we present and discuss experiences from a user-oriented approach used in a pre-study, where the possibilities to create a communication environment based on video between three different locations of a distributed workplace were investigated. The main purpose of the environment is to support co-ordination of activities, co-operation, and the sense of unity and common culture. Can such a video community be established? The workplace in question is the Stockholm County Police Call Centre, located on three islands in the Stockholm Archipelago: Arholma, Sandhamn, and Ornö.

The Call Centre started in the autumn of 1999, and has been in full use from June 2001. The Call Centre is a common resource, which is organized and managed as a single unit. It has a total of approximately 40 employees.

The primary task is to handle telephone reports from the general public concerning committed crimes (except ongoing crimes) as well as general questions. In October 2001 the Call Centre handled 11975 cases, i.e., 47% of all telephone reports to the Police in Stockholm. Although the workplace is distributed, the staff works together, sharing and following up on the same tasks, as well as creating a common work schedule. This requires extensive communication and co-ordination between the three sites. Currently co-ordination is accomplished mainly by telephone calls and e-mail. There is also a strong need for face-to-face meetings. However, the employees seldom meet, because of the large distances and problems with transportation. For example, an entire day is needed for a regular meeting in the city.

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From an initial assessment, we decided that the pre-study should focus on the question of how to establish efficient and rich channels for informal communication between the three locations. Traditional, face-to-face meetings are too cumbersome to organise and could not be held with sufficient frequency. The channels currently used for communication (e-mail and phone) are not flexible and rich enough to give support for efficient co-ordination. Moreover, with the kind and organisation of work at hand, it is important that a sense of unity and wholeness, as opposed to uniqueness and separation, can be maintained between the three locales of work.

Is it possible to create connections to distant places so they are experienced as immediate and natural extensions of the local environment, as communicative surfaces to co-workers at distant places? The question is in line with the research tradition of Media Spaces [2], of video- and audio connections that enable for people to work and to be together at a distance. As Mackay points out [7] "Media Space" refers to a special way of embedding the technology in the social environment and can include a range of forms of communication. Technically, Media Space refers to a continually open video- and audio connection, a technology which, of course, can be used for a variety of purposes, such as formal videoconferences, distance education, or contact with the general public in a number of scenarios. However, the focus of this pre-study is on informal encounters and peripheral awareness rather than formal meetings. The aim was to answer two questions: Would it be feasible to establish such a media space between the three places? If so, what characteristics should it have?

METHODS AND IMPLEMENTATION

The pre-study was performed in October-November 2001 as a collaboration between the Stockholm County Police, the Centre for User-Oriented IT-design (CID), and the Advanced Media Technology Laboratory (AMT), at the Royal Institute of Technology (KTH) in Stockholm, and Arbetstagarkonsult. AB, an independent consultant.

Multidisciplinarity

To establish a common media space between the three locales of the workplace would imply changes in the physical as well as the social aspects of the work environment. Thus, a multidisciplinary project team was created, including competencies from Architecture, Cinema Studies, Social Anthropology, Human-Computer Interaction, Industrial Design, and Media Technology. A representative from the Stockholm County Police also took part in the research group, as well as an independent consultant who had previously performed a survey concerning the work at the Call Centres.

A spectrum of user-oriented methods

Users, i.e., the staff at the three workplaces were involved in all stages of the pre-study. In order to avoid a technical focus, which too often has been the case with similar projects, a spectrum of user oriented methods was chosen that can be classified as contextual design [9] co-operative design [1] and participatory design [5].

As was pointed out earlier, establishing a media space would greatly affect the work situation. Thus, the staff had to be an active and equal participant in all stages of the design (participatory design). Equally, any design suggestion should take the whole context of use (work situation and -content) into account (contextual design), which can only be accomplished in co-operation with all the parties involved (co-operative design). This combination of methods (method triangulation) was a deliberate choice to ensure richness in the working material and a possibility to collect as many aspects as possible [4]. In practice, we chose to make workplace visits with presentations, discussions, and interviews (formal and informal), and to arrange a workshop. All activities were well-documented on paper, photos, and video.

Workplace visits and interviews

The three locations of the Call Centre were visited, one by one, by the project team in two rounds. At the first visit at each Call Centre, the aim and organisation of the pre-study was presented to the staff. The concept of establishing video- and audio connections between the three locations of the workplace to solve the problems of co-ordination and communication they experience was presented, as a general suggestion, without going into detail. Representatives of the research team answered questions and initiated a discussion about possible uses of a communication environment. At the first visit the research team also wanted to gain a general understanding of how the localities are used today, and to document the physical environment. The discussions and interviews with members of the staff were also documented.

The team also visited other units in the Police organisation to get an overview of the communication flow and to determine whether these units would benefit from similar communication environments at some point, later in the project, or if they should use other means of communication.

Workshop

Because the outcome of the first visit showed that the staff, in general, were positive to the idea of a common media space, the next step was taken and a whole-day workshop at the KTH was arranged with representatives from the workplace. The main intention was to open up an arena for discussion where all opinions mattered and the presuppositions of the research team would not overly affect the outcome. How did the staff envision the integration into their work process and the possible integration of a media space into their physical environment? In order to make ideas more concrete, to increase involvement and to activate the participants with the help of blueprints, pen, paper and glue, the discussion was somewhat geared towards the physical environment.

Figure 1. Members of the Call Centre staff discussing during workshop at KTH.

One aim of the workshop was also to let the staff experience communication over three working prototypes of the technology, locally between different rooms at the KTH. The prototypes were based on the ideas behind VideoCafé [8], a project at CID for a number of years, and on a technique for creating eye contact in videoconferencing that has been developed at AMT [10]. It should be pointed out that fibre-link connections are used in the system, and that the technical quality consequently is very high. This would also be the case for the actual media space, if it were to be installed.

All results were presented internally, discussed, and documented by the end of the workshop.

Renewed workplace visits

A second round of visits, more informal because all the people involved by now knew one another, followed up on the discussions from the first visit and on the results from the workshop. Another aim of this visit was to examine technical and architectural characteristics more in detail, and to discuss some alternative placements of a media space installation.

PRE-STUDY RESULTS

All of the instant reactions while exploring the prototype communication environment were positive. Spontaneous comments like: "fun, exciting, 'important to see the one you're talking to', 'creates a better connection to someone', 'now we can have a day-to-day contact'". But there were also hesitant considerations regarding monitoring ('lurking') and if it affects individuals relations to each other.

Figure 2. Members of the Call Centre staff using a prototype of the communication environment.

Functions and use scenarios

The staff came up with a whole range of possible areas of use for the media space:

? Informal meetings to increase co-operation.

? Experience-exchange.

? Company with others on remote site/s.

? Co-planning of work schedule.

? Decrease need for travel.

? Co-use of special competencies within the whole workgroup.

? Meetings for education, information, union meetings, etc.

Workplace effects

During the visits and the workshop, the project team discussed the physical environment with the staff. We arrived at a common understanding that whichever solution for integration of the communication environment would eventually be implemented, considerable alterations and restructuring of the localities to both host the technology and support the extended functionality would be needed. The boundaries of the communication environment (audio and video) need to be supported in the physical layout. You should not be able to be out-of-frame and still see or eavesdrop.

The work activities on the sites are surrounded with a demand for secure handling that has affected both the construction of the localities and the information technology already in use. This new communication environment need to meet the same requirements. As an extension to this, there will be specific requirements regarding activities in the communication environment. For example, since it, by definition, will emit sounds in the conduct (via loudspeakers from remote site/s and mouth at home location), this consequence need to be addressed.

The day-to-day contact will strengthen relationships between participants. But will the relationships formed in the communication environment become second-rate, as compared to those in the physical environment? Will there be new groups forming? Will the relations between the staff and their peers be affected? Will the work group seem larger with the use of the communication environment?

The activities need to be integrated in the present work flow, and the work flow needs to change according to these new inherent possibilities. The staff has already pinpointed several situations, for example the co-use of special competencies and co-planning of the work schedule, and these need to be implemented.

Principles for implementation

These principles are based on the specific requirements expressed by the user group in the activities described above.

Communication platform: The environment will primarily support informal communication in a day-to-day working context, and just like any other natural communication, the channel should always be open. In its default state, the user will not need to handle any functionality.

Reciprocity: If a person at a specific location sees and hears others on a remote site, then she is herself heard and seen. If any outgoing signal is disconnected by the user, the equivalent incoming signal is also disconnected. This guarantees that the user situation is equal at all existing nodes in the network and that 'lurking' is impossible.

Default mode: The environment will have a primary state (or default mode) which is 'always open'. If any additional modes are required, it should be obvious what mode you are in and how you get back to the default mode.

DISCUSSION & FUTURE WORK

As a whole, the information gained with the methods used in the pre-study was rich and useful, both within the frame of the pre-study and as a foundation for a possible future project. It seems that the main reasons for success is the participation of the staff from the Call Centre, i.e., the future users, but also contributions from the participating key persons from the Stockholm County Police.

From a methodological point of view we would like to emphasise a few points: Systematic, close work with the intended user group was not easy to accomplish because of how the workplaces were situated, and the variation in the working hours. Nevertheless, by the end of the period most of the staff had had the opportunity to participate, one way or another. The spectrum of methods and approaches used in this study, then, was an advantage. Not only were there many opportunities for people to express their views, there were also a number of different situations available for doing so. E.g., some individuals prefer to talk in small, informal groups, others are at their best in a more formal setting.

Pitfalls and risks

In a multidisciplinary project group it is important that all members share an understanding of aims and methods. During the project work some differences were noted. “User point of view” and “user participation” means different things and implies a different approach for somebody working within an organisation, or in the workers union, as compared to someone working with user centred system development. Such differences in approach were not fatal in this pre-study, but they imply a need to discuss at a greater depth how to establish a “common ground”, [3], i.e., the same goal for the work and the same understanding of how it should be carried out.

A specific caution in the project was to avoid a focus on technology. However, this proved to be difficult. First, we had a certain kind of system in mind at the outset and the work staff was not totally free to come up with any idea about what would satisfy their communication needs. Thus, there was already an implicit focus on technology from the outset. Second, as a consequence of this, the curiosity of the Call Centre staff had to be met, and it was not easy to know where to draw the line and direct discussions away from technology. A related problem, that needs to be met in the future, was a tendency of members both in the project group and the user group to come up with solutions, rather than to focus on what the needs were.

Future work

Hence, by working together with the to-be users, a useful foundation has been laid for the continuation of the project, which includes implementation of a system along the lines that emerged from the pre-study (see above). The feedback from the user group was positive concerning the multidisciplinary character of the project group and the methods used. The possibility to participate and influence the project was greatly appreciated and brought on a feeling of security and comfort.

We plan to continue the project in three phases. In phase 1, use scenarios will be developed further, in co-operation with the work staff. We will continue to focus on different uses for the communication environment and then gradually move towards practical implementation issues, i.e. functionality, technology, and the physical environment. The work will mainly be conducted as a series of workshops.

Phase 2 is a period of iterative installment in the workplace(s). Experimental versions will be set up as working prototypes, or equally good representations of the functionality, in the actual use situation. The principal method of study is participatory observation. The results will be used as a basis for successive refinements, and, eventually, determine how the communication environment is integrated into the workplace.

In phase 3, the environment is installed and in use. This will be an intense period of research with participatory observations and other kinds of observation studies. Interviews and questionnaires will also be used, as in all phases of the project.

If it, by the end of phase 3, turns out that the communication environment will not be permanented and that the effort must be abandoned, we also need to plan a debriefing period with the staff [6].

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Designing Future Scenarios for Electronic User Manuals

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ABSTRACT
This paper addresses ways of applying new perspectives on the electronic documentation of technical literature. It draws on inspirations from a research project aiming at creating a vision for technical literature that is electronically accessible. The goal was to investigate the potential of electronic user manuals and database user manual production.

We will illustrate how a variety of scenarios were helpful to add on intensive ethnographic field studies, helping developers coordinate design action and reflection. The design and implementation of electronic user manuals is beyond the scope of this paper.

Keywords
System development, ethnographic field study, qualitative methods, scenario-based design.

INTRODUCTION
At the turn of the millennium the Danfoss Company, a major Danish industrial manufacturer for refrigeration, heating and motion controls, became interested in making its catalogues, and related sales material electronically available. This political decision called for storage and management of the company's entire product data and product-related information in one central database.

The project affected the entire existing system of literature production (structure, management and publishing of data). Because the company's product range is based on principles of modularity, there was a strong interest in standardizing literature. But there are local variations in products that differ in nuances. Therefore the literature development process requires a certain kind of dynamism that allows adjustments according to product variations. So reuse of assets across product range was desired.

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The notion of 'across products' was regarded as directly linked to 'processes'. By focusing on processes the company aimed at widening for competitive marketing arguments. Instead of technical and functional product description stakeholders could best imagine literature to be based on a use case model. The latter called instantly to take in to consideration a scenario based design process (Bødker 2000) where users are perceived as co-designers in contrast to usability studies users only role would be to accept or reject a concept tested.

The challenge for designing a system across all products was to seek information about how to employ electronic devices for user manuals and instructions, possibly handheld, and ubiquitous. The question was: What could a possible future information system look like?

The project ran for 6 months from August 2000 onwards. User research with a set of conceptual prototyping experiments was carried out in different work environments in Denmark, Germany and the US. A series of workshop like activities (e.g. best practice seminar, core team meetings, video analysis session) tied the project together.

To explore the potential of using electronic media, we studied current use and recent production of existing technical literature. Research activities and testing prototype concepts ran in parallel to prompt user opinions. Investigations in database production tools were accompanied with the approval of a hands-on pilot database.

PROJECT TEAM ORGANIZATION
The project team actually consisted of three groups of players in the team: The User Centered Design Team, the Core Team, and the Stakeholders Group.

The UCD team was a multidisciplinary team of designers with qualifications such as anthropologist, industrial designer, communications designer, internal rotation engineer, and a design process manager. The User Centered Design team members took the role as process architects who mediated among the players of the game (Horgen et. al. 1999).

Core team members were a marketing consultant, a technical literature engineer, sales & marketing engineer, and a technical literature manager.

Stakeholders were a product support manager for electronic controls and a marketing manager for technical communications.

As it were a fourth team end users (operators, service technicians) participated in the Video Card Game analysis session. They of course assisted in the field providing information and giving insight into their knowledge.

In fact core team members and stakeholders as well were regarded as just another kind of users of technical literature. As mediators of technical documentation they share with operators and service techs an interest in the overall design, just on another level.

Right from the start we decided to regard the entire project team organization as an assembly of multivariate players in the design process. All members ("players of the game", Horgen et. al. 1999) did hold different images of the workplace, pursued different and often conflicting objectives, and sought to protect their respective interests. Core team members and stakeholders came from different divisions of the same big organization, each division having its own tradition and organizational culture. Their institutional roles and their personal styles determined how they saw and solved problems, and how they responded to interpersonal relationships. They have specific roles and positions of authority, and they play them differently.

Thus we early thought best to apply the metaphor of the game for the design team organization and for the design process architecture: A game is a social activity within a system of rules in which multiple actors with defined roles cooperate to achieve a desired outcome (Horgen et. al. 1999:42). Because Horgens idea of a Process Architecture Approach is closely linked to the ideal of a Co-Design Approach, we easily could connect our particular design task with the principles of a User Centered Design Approach.

COURSE OF INQUIRY

Research started out with observing work, and interviewing users. Field research was exclusively conducted with a video camcorder. Video transcripts and field notes were carefully examined to identify common topics and general interaction patterns. All video material was analyzed according to the principles of the 'Video-Card-Game' method (Buur 1999; Sperschneider 1999, Buur/Søndergaard 2000).

For the field study we asked users to carry out their planned duties, while we kept a log of their activities during the course of the day. If possible the field technique of 'shadowing' informants (Sperschneider/Bagger 2002) was employed: We followed users in their daily routine, and recorded what occurred, e.g. a sudden troubleshooting situation. With this technique we followed the ethnographic ideal of participant observation (Spradley 1980, Wolcott 1995).

At the end of a day, we interviewed the people we collaborated with to ensure a complete log all activities. During these interviews we focused on issues such as the nature of the activities carried out, how long these activities normally take, and the kinds of documents and document-related tools they used.

On other occasions the 'situated interview' technique was used (Sperschneider/Bagger 2002). We conducted interviews on location using qualitative interview techniques. Questions formulated in advance became reformulated according to adjust to the flow of articulations.

Field observations were intended with the objective to identify generally reoccurring familiar situations that could help defining patterns of interaction with paper manuals. These patterns than should serve designing future scenarios.

Users experiences with manuals, e.g. installation and maintenance of current heating and refrigeration controllers, were initially studied over a six-weeks period at Denmark. At the Danfoss Help Desk Center we spent two weeks observing and interviewing service technicians, listening to customer call-ins, and trying to get a clue of all those many frequently asked questions.

At the Danfoss Help Desk Center we learned that there isn't anything existing to be called "frequently asked questions". Each problem has its own context. Therefore each question needs to be reflected in the particular context of its occurrence. Here we learned that the phone is an inevitably vital tool for interacting with manuals. Some operators prepare well before going out for a job. Some don't like to prepare at all. They prefer to be supervised or instructed. Others like to learn from experience, may be trial and error.

At the Danfoss Drives division we studied recent practice of technical literature production. This was a matter of specific interest because DD is a leader in fully automated parallel processing of technical documentation. DD has developed a unique system that generates automatic setup for any literature product desired. This saves much of text editor's time.

To explore the potential of electronic media we invited a number of cutting edge professionals with multiple backgrounds to discuss best practices in applying electronic media for documenting technology. For the Best

Practice Seminar and Core Team meeting the process architects presented the first set of studies on how operators and service technicians actually work with user manuals. The goal was uncover the plain descriptive patterns of work practice.

The persona of users and user perceptions of current technical literature saw three patterns that became important key features for design scenarios:

- Subject oriented feature: The operator as gold-digger, seeking frantically information;
- Image oriented feature: The service technician as visual thinker, remembering visually, communicating via pictures or photos;
- Scholarship oriented feature: The operator as apprentice on new territory, seeking instruction.

Hundreds of post-it notes from the Best Practice Seminar were analyzed with the KJ-method for information structuring and problem solving (Buur 1990): Post-its are grouped in larger and even larger groups of similar subject matter. Finally they are arranged in a graphical structure on large sheets of paper.

Core Team 1 evaluation, which followed the BPS meeting, helped to formulate three prototype concepts as springboards for design scenarios (Bødker/Christiansen 1997):

- The prep-assistant applies electronic media to support situated learning;
- The voice guide uses sound as an alternative to sheets with text and graphics;
- The on-site helper is a mobile computing device with a search machine.

Each prototype concept became embedded into a scenario that served to point at a mutual understanding of problems in current work. Rather than meant to evaluate prototype user interfaces for their usability, they were designed to provoke new ideas and for feedback for design refinement.

User feedback on all three prototypes was gained on further field studies in Germany and the US. In these studies we were sought evidence for the basic principles underpinning the patterns observed in the Danish field. With the design of three contextual scenarios all-around the prototypes we were looking for comparison across the patterns.

User trial and response again was videoed for systematic reflection. The 'Video-Card-Game' evaluation session helped to refine current visions, and evoked a range of both technically and humanely general issues for any electronic documentation system.

Any concept for future electronic user manual formats should consider differences in articulation and distinctiveness for addressing global users. Language suited to service technicians (operators and fitters) in the US should be at a lower grade level of readability than for service technicians at Europe. US service techs are not so well educated, and are less well trained vocationally.

This opened for ideas of designing a simple prototype system for in-house technical literature production. The design on the Danfoss Drives fully automated technical literature production line was carried out as a design-in-context session (Buur/Djajadiningrat/Pedersen/Sperschneider 2002). This allowed a deeper understanding of a whole range of implications and consequences that need to be tackled once a single-source database supports different media. Future manuals production inevitably will change recent roles. Technical writers will become info providers, if not information architects.

Core Team meeting 2 started out with stakeholders and fellow researchers experienced the mock-ups personally in typical workplace settings (heating room, refrigeration room, van for preparation): Core teamer's were asked not only to test the prototypes, but to add on them, thus making them more concrete. The task given was: If this is an idea, what is necessary to turn it into a product? Situated practical understanding (Lave/Wenger 1991) via hands-on experience helped core teamer's and design team members to share users implicit meanings, thereby transforming tacit knowledge into meaningful insights (Nonaka/Takeuchi 1995).

The next and final step in the design process, that could lead to requirement scenarios where pros and cons of a particular design situation would be scrutinized, hasn't started yet.

USER PERSPECTIVES ON MANUALS

The notion of *users* is a very broad category. Users of technical literature could be anyone who deals or handles with them or with controllers. In order to evoke work practice we refer in the following to perspectives of operators, maintenance personnel, and service technicians, thus avoiding the peculiar notion of 'end users'.

The Apprentice – I'll better be well prepared

The apprentice taught us to keep an eye on transfer of knowledge, e.g. on how to teach a colleague. The apprentice favors built-in support rather than a paper manual. He prefers typical use scenarios instead of technical explanations.

The Gold-Digger - I know what to look for …

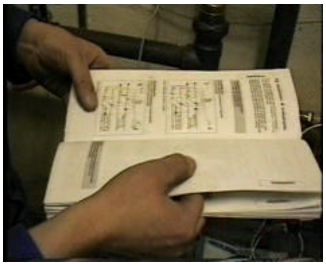
The gold-digger expects skillful expert guidance. This user type calls for the appropriate media, whether electronic or paper. The display of electronic manuals should look like the paper manual. Paper manuals should stay.

The Visual Thinker - I remember what it looked like...

The visual thinker knows what to look for. He favors visualization: 'A picture is worth a thousand words'. Photos, diagrams, illustrations, figures, all are good for straightforward communication.

The quality of paper

Users stress the flexibility of paper documents. Hand delivery enables users to highlight particular sections. With annotation information becomes personalized.



Christian remembers a mark he had made earlier in his very own manual. It is the hand-written cross that he remembers, and that he is looking for while leafing through the manual.

User feedback supported the claim made by Harper and Sellen (1995:10): The argument is not that paper is universally better than electronic alternatives, but the role of paper in fundamental aspects of work practice is misapprehended and under-emphasized (Sellen and Harper 1997). Paper symbolizes importance, and it personalizes the process. Paper stays, digits disappear. The tangibility of paper and its physical presence is a continuous reminder to actions and activity.

PROTOTYPE CONCEPTS AS SCENARIOS

Bødker/Christiansen 1997 take scenarios in design as hypothesizes. Scenarios are qualified guesses about the future (1997:12). These authors see scenarios as a way of referring back to use praxis. But they warn us not to take them as physical entities. Otherwise we might overemphasize aspects of the artifact. However we would like to argue, if co-designed with users, a tool neatly can serve as springboard for further design idea: the tool gives meaning for both designers and users. Tools and artifacts embody design ideas. Thus we assumed they well might help transforming tacit knowledge into explicit knowledge (Nonaka/Takeuchi 1995), thereby provoking the generation of users' ideas.

Bearing this theoretical reasoning in mind we developed for each prototype a scenario, a 'story' located in time and space, based on our knowledge about patters for typical ways of doing things. Iterative alternation between field research and core team/stakeholder refinement lead the process architects to approve three prototype concepts in the German and American field.

The On-site Helper

The On-site Helper is a paper mockup WAP cell phone. This tool allows both searches by text and search by image. The On-site Helper appeals to both the subject oriented and the image oriented user pattern. As described above for the gold-digger this artifact allows a service technician to find answers himself. The concept is closely linked with the idea of a single-source database.

The Voice Guide

The Voice Guide is a laptop based acoustic instruction guide that works with an earphone. It allows an operator to keep his hands free. The idea for the scenario: the operator gets connected to the manufacturers' web page via modem in the apparatus. He just plugs in his earphone and gets instructions for set up and maintenance and so forth. But voice navigation is far from the richness of visual navigational capabilities (Muller 1990).

The Prep Assistant

The Prep Assistant is a multimedia application on a portable computing device. Video takes commend how to solve relevant problems. Visual navigation may be accomplished through other media, e.g. audio devices. Navigational options may be presented simultaneously in a display. This artifact could be taken along to a worksite, or it could be approved in a van during a lunch break as the scenario suggested.

CONCLUSION

Feedback from both internal and external users implied to link all documentation to one single-source database, using the same information for different media. The database

should contain text, pictures, video and sound elements. Reuse of information, e.g. of earlier products and software is an important issue.
Future electronic literature might be based on the computing principles of hypertext and hypermedia. All traditional text is sequential, thus defining the order in which the text is to be read. Hypertext is non-sequential. Hypermedia supports neatly a range of multimedia accessories.
Today's principles of manual production shortly before product launch will eventually change. Thinking in terms of audible and visual devices this will result in new roles, and new ways of working. Text writers will turn into coordinators of different media providing information in multiple ways. The information provider of the future will be concerned with data management and web facilitation.
The aim of this project was to outline the boundaries for electronic forms of technical documentation, their design, their production and their maintenance. One promising way to employ electronic media would be via an audio-only media space (Hindus et. al. 1996) as exemplified in the voice guide scenario. Information and guidance should be accessible via the apparatus itself, either as download online service or as embedded software. Controllers with online potential will give access to information where information is needed. But any innovative development that considers the optimal care of users must also be capable of including future paper manuals.
It became clear that any new electronic user manual concept would give way for new ways of generating technical literature, thereby turning technical writers into media coordinators or information architects. Aspects of database production and of delivery system should be painstakingly considered in a global text writer commission.

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Non-user centered design of personal mobile technologies

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ABSTRACT
During design and development of personal mobile communication technologies, various user centered design approaches are frequently used. Based on results from three ethnographic studies of bike messenger operations, bike police operation and field engineering operations, we argue that understanding of the non-user and the relation between the user and the non-user is important. The cellular telephone is used as an example of a personal mobile technology throughout the paper to talk about the role of the non-user and the relation between the user and the non-user.

Keywords
Mobility, system development, contextual inquiry.

INTRODUCTION
Telephones have become ubiquitous in the western world. Today we take the fixed telephone for granted in private and public places. It is acknowledged that the introduction of the fixed telephone led to major changes in society [5], both for the users of the technology and for the ones that do not use it. Even for groups that do not integrate the telephone into the daily life in the western world the telephone represents changes in everyday routines [12]. Today, derivatives of the fixed telephone, the computer and the radio are used in homes, at offices and public places. Both the use of cellular telephones, pagers, PDAs, augmented reality technologies [3] wearable technologies [10, 11] are at rapid speed entering into various public and private places, like restaurants [7], parks, pavements, homes, beaches and office premises.

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End user, user, consumer, community, buyer, client, owner, focus groups, participant, person, actor, operator, panels - these are notions that are used to describe various actors when doing design and development or investigations of the use of personal mobile technologies. There are indeed many terms that are used to denote the person interacting with a communication or information system – in addition to the general term "user". In this paper we are asking the question "is there any relation between the user and non-user of personal mobile technologies?" Then we are trying to find out what we can learn from answering this question.

The paper is built up in the following way. We start by describing what we mean by the non-user. After this, we present the empirical research that has informed the discussion about the non-user of personal mobile technologies. Before the conclusion and call for future research in this area, we present theoretical concepts from the "social construction of technology" tradition which enable us to talk about the non-user.

USERS AND NON-USERS
We argue that the concerns of the non-users are important when working with investigations, descriptions, analysis and design of personal mobile technologies. By considering the non-user, possible negative consequences for the non-users may be reduced, possible positive consequences may be enhanced and possible neutral consequences of use understood. The non-user is a person who is in the region of a user. The region of a user is described as a location that is bounded by the perception of the material sensory faculty of a person [6]. The description of the user, the non-user, uses and non-use is not rigidly defining categories in this paper, because of the dynamic and fluid nature of these phenomena. A person may indeed be a user in one location or in one situation and a non-user in another situation.

In a given region, there may be none, one, two or more people present. If there is only one person, there will be no non-users, since a non-user exists on the background of users in the region. If there are two persons present in the region where one person is using personal mobile technologies and the other person is not using this technology we have a situation where there is one user and one non-user.

When talking about users and non-users, it is important to be clear about who is who. Should we understand a user A, who is calling from a fixed telephone to user B, who is using a cellular phone, as a user of mobile communication technologies? Since almost all people in the western world are users of fixed telephones, and from time to time make calls to cellular phones are we all becoming users of mobile communications technologies? This question raises a general concern about who the non-users of mobile technologies are. As the example indicates, from one perspective there are no non-users. However, we will call any person that is not using or operating the personal communication terminal directly as non-users in this paper.

FIELD STUDY

The field study that has informed this paper has been conducted with the contextual inquiry technique [2] of bike messenger operations and bike police operations and field engineering operations at various places. Usability engineering techniques [4] have been used to analyze and inform design about central issues concerning the user and the use of mobile communication technologies. The communication systems in use are on the infrastructure side cellular systems, private mobile radio systems and Internet infrastructure and on the terminal side, cellular phones, pagers, palmtop computers, smart phones, cellular packet devices, radios, and handsfree sets. In the following description, we will use the term personal communication appliance as a generic term for any terminal component. The use of the various personal communication appliances has been investigated when the user is using footwear, bicycle and automobiles for physical movement in space. The use of telecommunication terminals and services while biking has been the main object of study for this research that started in 1997. One full time researcher and eight part time students conducted the research.

By using the contextual inquiry technique, we have been able to collect information about the context in which various technologies for physical movement, footwear, bicycles and automobiles are used together with various technologies for communication over distance, the personal communication appliances. The contextual inquiry technique has made it possible to describe the user side of these technologies, but also the non-users that are part of the context that has been studied.

From our field studies, we have identified a number of non-users and relations between the user and the non-users. One such instance of a relation between a user and non-user is presented below in the form of a strip of talk:

> Bente: Hello.
>
> Anders: Where is it?
>
> Hans: At the other place.

This strip of talk is between Bente who is working as a receptionist, Anders who is working as a bicycle messenger and Hans who is working as a dispatcher. Bente and Anders are co-present in a reception area, and Hans is at the bicycle dispatching center. Hans is present in the ear-piece worn by Anders by his disembodied voice channeled through the cellular telephone and the corresponding services and networks. Bente is here the non-user. She is attempting to greet Anders who is approaching her desk with the word “Hello” and the corresponding gesture and facial expression. Anders is engaged in a conversation over distance with Hans, and he is asking and receiving a reply from him. This strip of talk has introduced a person who we call the non-user. In the next section, we will describe the experience of a non-user and the relation between the user and the non-user.

NON-USER EXPERIENCE

We are interested and concerned about the non-user and about how users and non-users experience the use of personal mobile technologies in situ. Our starting point is our five human sense-organs, i.e. the faculties of eye, ear, nose, tongue, and body, and their corresponding objects in the external world, i.e., visible form, sound, odour, taste and tangible things. Only the realm of acting with communication artifacts in contexts is included in our discussion. We will therefore also try to describe how these artifacts are patterning actions and behaviour of the non-users that are sharing space with the users.

The cellular telephone is used as an instance of a personal mobile technology, and the experience of it with respect to the five material sense organs is described below. We will see that the examples illustrate the relationship between the user and the non-user of this technology as an inter-dependent relationship. This description is made, so that we are able to analyze the non-use of personal mobile technologies. The descriptions below illustrate the relation between the user of a cellular telephone and the non-user with respect to the five material senses.

Visible form region: The eye of the non-user will see the visible form of a personal communication appliance from some distance. Since the personal communication appliances are often substantially smaller objects than a human body, the personal communication appliance may be inside bags or pockets, and hence not exposed visibly to the non -user. The size of the region is different in crowded places and secluded places. The non-user will be in the visual region of the personal communication appliance, when the personal communication appliance is both switched on and off. In dark places, the light emitted from the personal communication appliance, and not the body of the personal communication appliance itself will determine the visible form region. The non-user will normally see the whole user of the personal communication appliance when in the visible form region of the personal communication appliance.

Sound region: The ear of the non-user will hear the sound of the personal communication appliance at various distances. When the personal communication appliance is off there will be no sound region. Sound may be generated by the personal communication appliance itself, or by the user that is talking with the appliance or with a distant party. If the personal communication appliance has loudspeaker capabilities, the non-user may engage actively in the use of the personal communication appliance.

Odour region: For current cellular terminals this region is not relevant for the discussion.

Taste region: For current cellular terminals this region is not relevant for the discussion.

Tangible things region: The body of the non-user is normally not experiencing the tangible things region of the personal communication appliance when the non-user and the personal communication appliance are in close proximity. The user and the non-user of the personal communication appliance may operate the personal communication appliance together, for sharing visuals and audio from the personal communication appliance.

The description and analysis above is done to illustrate the effects of the senses that the use of the technology may have on the non-user. Since the non-user is affected by the use of the technologies it is of importance when considering the use of these technologies.

When being together in the physical world, we are used to communicating with facial expressions, body postures and voice. When we use artifacts as extension of our senses, there are some challenges and possibilities arising. Donald Norman [8] describes the turn signs of a car as the facial expression of automobiles. When we use an automobile, the non-users will perceive the "person and the automobile" as one entity. What co-present people observe then is not our facial expression, but the hull of the automobile? The user of the automobile is perceived as approximately two tons of steel, some light, horn and turn signals. When a user of clothes and shoes is in the proximity of a person that is not using clothes and footwear, the non-user perceives a "person that is dressed in clothes and footwear". If we dress in an automobile or if we dress in clothes, we will be perceived differently by the non-user.

What happens when our engagement is not visible to the co-present people in our region, that is to the non-users? What techniques, methods and technologies do exist to guide and help the user and the non-user in situations where there is a conflict between communication in the shared region between the communicating parties, and invisible communication outside the region? This is one of the questions which the focus on the non-user has triggered. In order to find answers to this and other questions that arise when considering the view of the non-user we need an adequate vocabulary and a theoretical framework. In the next section, we will present some background theory that has provided a language with which we can talk about the non-user.

RELEVANT SOCIAL GROUPS

From the tradition of social construction of technology, we will look into some analytic devices that may be useful for our concern of the non-users. The approach of social construction of technology (SCOT) is concerned about relevant social groups [9]. A relevant social group is defined when "all members of a certain social group share the same set of meanings, attached to a specific artifact" ([9], p. 30). However, the description also includes less obvious social groups that need to be included. In the case of the automobile the "anti-automobile actor" is an important relevant social group. The concept of relevant social groups gives analytic devices to describe and analyze various groups and the problems and solutions that are perceived by them in the meeting with new technological solutions.

Pinch and Bijker (1989) point out the importance of dividing the defined social groups into several groups, since groups are heterogeneous. In the case of defining non-users as one relevant social group it would be of importance also to divide non-users into categories of different reactions and experiences with the technology in question. The development of technologies is seen as a social process, where there is interpretative flexibility by the various relevant social groups of the perceived problems and solutions. The social construction of technology discipline has mainly been used for historical analysis of the development, diffusion, stabilization and closure of technologies. The part of non-users specifically and relevant social groups generally that are affected by the use of technology might also be used to inform design.

The seminal book "The Social Construction of Reality" [1] has had a large impact on various scientific disciplines since it was published. The theory presented in this book is also the background theory for the social construction of technology tradition. This discipline views the construction of technological systems and artifacts as a network of actors that are involved in evolving and stabilizing technological systems. The description and analysis of how technological artifacts are engineered, invented, designed, implemented, adopted, developed and stabilized in social construction of technology is different from the linear development model of technology that is found in many system development methods. The interpretative flexibility from various social relevant groups is a key point.

By the concept of interpretative flexibility, different interpretations of artifacts are captured, making it likely to show "that different social groups have radically different interpretations of one technological artifact" ([9], p. 41). The concept is used to show how artifacts are culturally constructed and interpreted. Combined with the perspective of non-users, interpretative flexibility opens up for discussing how different interpretations by users and non-users are culturally negotiated, ending up in norms of behavior and habits of use of the artifact. One example of this would be the expected withdrawal from the audio region of non-users when receiving a phone call on the mobile telephone, while it is still accepted to answer an SMS message in the same region.

SUMMARY AND FUTURE WORK

In this paper, we have investigated the role of the non-user and the relation between the user and the non-user of personal mobile communication technologies. We have argued that there is a relation between the user and the non-user of such technologies.

With the increasing use of personal communication appliances in private and public places, and the technology research that is going on in the area of wearable computing and communication and augmented reality, we argue that this is an important concern today, and will likely continue to be so in the future.

There are a number of questions and concerns that have to be considered carefully, and that are opened up in this paper:

- Finding out who the non-users are.
- The challenge of getting the view of the non-user.
- Answering the question of what problems and solutions the non-user perceives.
- The challenge of incorporating the view of the non-user in the investigation method and the design process.
- Finding out in which ways the user affects the non-user, and the ways in which the non-user affects the user.
- What effects will the non-user centered design have on the “haves and the have nots” [13].

There are a number of challenges in this area of non-user centered research. A starting point is to engage in ethnographically oriented studies of current practices. This to be able to get rich descriptions of the whole context of use, and not narrow task descriptions, profiles of users, goals of the operations and so forth – limiting the object of study to the user and the use of the technology in question.

Examples, and sound theoretical foundations, are necessary to prove that better solutions will be the result if the non-users are taken seriously, for the operators, the vendors and the customers, in addition to the non-users. It is possible to learn from the user and non-users of domesticated and stable technologies such as the automobile.

We will continue to investigate the use and non-use of personal mobile communication technologies.

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Ethnography in design: tool-kit or analytic science?

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ABSTRACT

The role of ethnography in system development is discussed through the selective application of an ethnographic easy-to-use toolkit, Contextual Design, by a computer firm in the initial stages of the development of a health care system.

Keywords

Contextual Design, ethnography, system development.

INTRODUCTION

In the spring of 2001, Electronic Formations (a fictitious name. EF onwards) engaged upon the development of software to be used in hospitals. The firm had little previous experience with hospitals and health care in general and thus found it necessary to introduce a much higher degree of user-involvement than it had previously practiced in system development. It came to rely heavily on Contextual Design (CD) (Beyer & Holzblatt 1998), which is a toolkit for computer scientists through which to obtain domain knowledge through qualitative methods used in ethnography in combination with paper-prototyping (Kyng 1988).

I use the case of EF and their use of CD to discuss to role of ethnography in system development. Sociology, psychology and now ethnography have been introduced to system development over the last 15 years as a way of gaining knowledge about users, but their role and use are disputed (See e.g. Anderson 1994; Rogers 2001).

ETNOGRAPHY AND SYSTEM DEVELOPMENT

The interest for the social sciences has developed from practical experiences within Participatory Design where direct interaction between developers and users forms the central axis in the design of new computer systems (Bødker 1989 and 1996; Greenbaum & Kyng 1991, Kensing & Blomberg 1998). A more academic root has been has work such as Lucy Suchman's *Plans and Situated Action* (1986).

As the fields of HCI and CSCW have developed, cross-disciplinary cooperation has expanded and can looked upon at two levels: a) the transfer of knowledge from one field to another and b) inter-personal collaboration.

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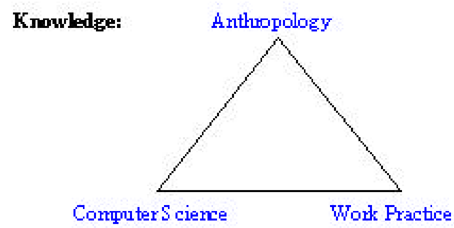
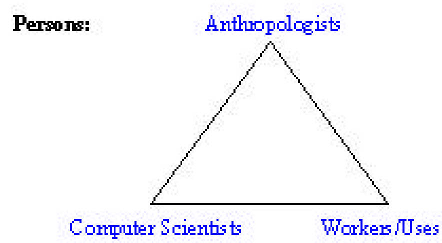
At the level of knowledge the problem is how to achieve a transfer from one field to another. One suggestion is to develop a lingua franca and poignant metaphors that enable communication between developers and the social sciences has been proposed (e.g. Rogers 2001:25). The concept of 'common information spaces' from the CSCW field is a way forward in this direction (Bannon & Schmidt 1992; Bannon & Bødker 1997). Another suggestion is to create a new field, 'techno-methodology', in which the social and the computers sciences could meet and merge (Button & Dourish 1997). Figuratively, this level can be represented as below:



(Figure 1: The Level of Knowledge)

At the level of persons, the question arises how and in which stages ethnographers should be incorporated into system development. Hughes et al (1994) present four models: concurrent ethnography (ethnographic studies are carried out and reported concurrently with system development); quick and dirty ethnography (brief ethnographic studies undertaken to inform designers); evaluative ethnography (design decisions are evaluated by an ethnographic study); and re-examinative ethnography (previous studies are re-examined to inform initial design). Figuratively this can be represented as below:



(Figure 2. The level of Persons)

Bob Anderson argues that system developers are only interested in ethnography's data-gathering techniques, but not in its investigations and analysis (Anderson 1990: 178-9. See also Forsyth 1999). Ethnography implies prolonged periods of fieldwork and is therefore time-consuming, costly and has s a long 'deliverance'-horizon. Therefore, it is usually used in its 'quick and dirty'-variety (Millen 2000), or by adoption of some of its methodologies: observation of informants in context and qualitative interviews. The question is whether this is really what designers want ? I discuss this through the case of EF.

CONTEXTUAL DESIGN

CD has been developed by Hugh Beyer and Karen Holzblatt (1998) who have worked as consultants for system developers for some years. The concept's ambition is to cover the whole process of design from initial information gathering, visioning of a new system and actual coding and implementation. Focus here is on Contextual Inquiry (CI), the proposed method of information gathering.

The theoretical social science background seems to lie in grounded theory and ethnomethodology (judging from their references), and CD shares with these an emphasis on observation of people in their working context, a elicitation of tacit knowledge and an inductive approach to observation and description. It is tailored to be practical, close to the concerns of developers and without time-consuming (and costly) processes of ethnography(ers). It is a commercial product and has reportedly been successfully applied by developers (See *interactions* Jan-Feb 2001).

CD proclaims itself to be a 'customer-centered' approach to design which means that data gained from customers should inform the design process from start to end. The method for gathering information is CI (Holzblatt & Jones 1993), which applies the ethnographically well-established techniques of qualitative interviews and observation of actors in context: "Contextual Inquiry is a filed data-gathering technique that studies a few carefully selected individuals in depth to arrive at a fuller understanding of the work practice across all customers. … Contextual Inquiry is based on a set of principles that allows it to be molded to each situation that a project encounters: context, go to the customers' workplace and watch them do their own work; partnership, talk to them about their work and engage them in uncovering unarticulated aspects of work; interpretation, develop a shared understanding with the customer about the aspects of work that matter; and focus, direct the inquiry from a clear understanding of your own purpose. These principles guide the creation of a data-gathering technique to collect the best data possible given the constraints of the situation." (Beyer & Holzblatt 1998:38).

The central persons in this process are the designers, since neither customers, user representatives, marketing people or the it-department, according to CD, can combine the necessary focused interest in knowledge about technology and users' work (Beyer & Holzblatt 1998: 30, 33, 34, 217).
CD describes how to conduct interviews and the role developers should have when talking to users (apprentice-master). The roles interviewee-interviewer; novice-expert and host-guest should be avoided (Beyer & Holzblatt 1998:56). Interviews and observations are followed up in interpretation sessions where interviewers present their finding to others and models of work are jointly constructed through five graphical work models: flow-models describe people and artifacts in a work process; artifact models describe the props employed; sequence-models describe the sequentiality of a work process; and physical models describe the physical environment. Initial models should represent the empirical observations of one user only, while latter models through a process of 'consolidation' become generalized representations of the work of a group of users. These are validated by presenting them to customers.

Critical assessment

From an ethnographic point of view the emphasis on primary data gained through something similar to participant-observation, ethnography's central method, as the basis for system development does of course seem sound. From the same point of view, however, certain reservations come up. Firstly, while CD proclaims to be 'user-centered', 'designer-centered' might be a more appropriate label, since these are the central persons in the process. Users primarily provide data and evaluate ideas, but are not active in design itself except if paper-prototyping is engaged upon. With this positioning of the develops, the methods provided for data-gathering becomes essential and here CD seems naïve and avoiding central issues. While time-pressure within system development might make it reasonable to assert, as CD does, that 10-20 interviews lasting 2-3 hours are sufficient to gather the required information. It does seem rather naïve however to claim that a 'true partnership' (Beyer & Holzblatt 1998:53) between interviewer and interviewee can develop within such a short time. Gender, status, ethnicity and class will almost always at play in human interaction and will not be overcome by an even benevolent and polite designer. Within such a short time, the risk of developers (and users) not moving beyond common sense and/or mutual preconceptions is great and enhanced by the inductive form of knowledge construction advocated and CD does not offer any means as how to reflect and become aware of this. This 'naïve' approach, is also seen in CD's use of 'customer' as cover-term for contractor, management and end-users, and thus glazing over the differences between them. According to CD "a system must meet the needs of *all* those who depend on it…" (Beyer & Holzblatt 1998:2) and according to CD system development is always also the design of a new work practice. However, different groups and people would have different interests and positions of power in such a process. Instead of confronting this problem head on, CD only spends a few lines on power within a discussion of the cultural work model. Finally, analysis of data is absent unless the graphical work models are taken as such.

Thus, while the sound core of CD is its emphasis on first-hand data collection by developers, its 'naïve' model of how developers and users relate to each other, a disregard for the role of power, class, gender and ethnicity in system development and an absence of analysis of data seem to call for caution. On the other hand, the CD is the product of two successful consultants and is apparently bought and applied by many system-developing firms. It would seen, that the tool-kit provides the support that is 'designers, themselves' want? I will return to this question after having presented the case of Electronic Formations.

ELECTRONIC FORMATIONS

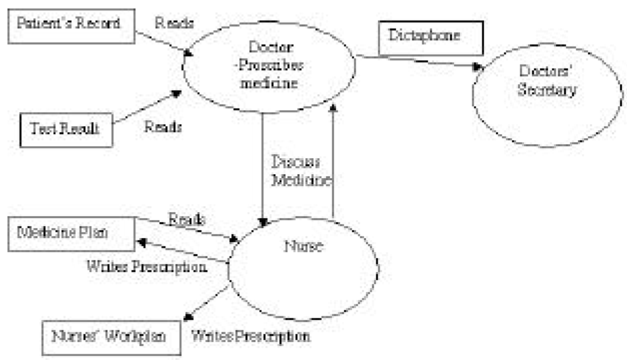
In the spring of 2001, I followed the initial design process of EF closely, and the following is based on recording and extensive notes from that fieldwork, as well as on documents from EF.

EF has successfully programmed software and expanded considerable during the last 10 years. In 2001, it engaged upon a project with healthcare of which it had little domain knowledge and therefore commenced a process of user-involvement of which the firm had little previous experience. My focus in the following will be on the two initial stages in EF's development process, since this is where the ethnographic methodology of CI was mainly applied. In the first knowledge-gathering phase, the team was to a series of field trip to different hospitals, while the second phase consisted in a series of vision workshops where the new system to be constructed would be outlined. Thereafter, requirements specifications were formulated and a contract between the contractor and the firm was finalized. In a fourth phase, the final product is developed through an iterative process with four steps.

The phase of knowledge-gathering

The people involved stressed that they did not follow any method, nor CD, by the book, but adjusted it to what they thought worked best. For example, the firm had hired a nurse and a laboratorian to gain user knowledge about health care, thus deviating from the reservations in CD towards user representatives. The nurse had written a document in which he explained central concepts and listed a number of acts and phenomenon, which they ought to observe during their field trips. This list helped the developers to have a specific focus during their field visits, and it was used almost as a checklist to whether they had seen all they wanted. Whether it also worked against grounding observations on the information gathered from clinicians in context, as recommended by CD, by preconceptualising the developers remains an open question.

The trips were planned together with a physician who worked at a hospital and who was the contractor's representative towards the firm. Every week, two days were planned for field trips each followed by an interpretation day. All in all, 7 developers conducted 18 field trips at three hospitals and the central hospital pharmacy during three weeks. During these fieldtrips the developers (including the nurse) were to conduct an interview with a clinician - a nurse, doctor or pharmacist - whom they followed around during work at their respective wards. The next day usually started with 2 to 3 hours where each developer individually wrote up the observations from the preceding day in prose as well as representing them in on or more of the work models of Contextual Design (Similar to figure 3).



(Figure 3. Flow Model of Prescription of Medicine)

Thereafter, the whole team met and spent the next 3 to 4 hours presenting their work models to the rest of the time. These sessions were modeled rather closely to the roles and ways of the interpretation sessions described in CD, and as intended here the sessions led to a significant degree of knowledge-sharing. The 3-week information-gathering period was concluded with a one-day meeting between the developing team and a group of doctors, nurses, doctor's secretaries and pharmacists. Here the team presented their findings via general work models of e.g. a doctor's prescription of medicine, a nurse's giving of medicine or a pharmacists ordering of.

The phase of visioning and requirements specification

The knowledge-gathering phase was followed by 6 workshops that were to create visions for the new healthcare system and lead to specification of user requirements upon which the commercial contract between was based.

The workshops were divided into the themes of prescription, administration and ordering of medicine, which were repeated twice. The workshops were organized around paper mock-ups as described in CD which refers to Kyng 1988 and Ehn & Kyng 1991). The developers had prepared a series of work-scenarios that gave the context for the clinicians' construction of a paper prototype of a user interface. There was no collective conclusion of this phase between clinicians and developers other than the official requirements specifications agreed upon by the firm and the contractor. The knowledge gathered from these two initial stages is the basis for the final, iterative design process that started a few months afterwards.

Methodological choices

In this process, the team from Electronic Formation took a number of methodological choices which I will discuss below. At issue is neither the extent to which the followed CD to the book nor whether their deviations were right or wrong.

Firstly, the firm had opted to include a nurse and a laboratorian in the development of the system. This obviously helped the team to get direct access to expert knowledge on health care and helped them understand the field's expert terms and having a focus during the field trips.

Secondly, the team almost solely developed flow models of the work processes observed and collected numerous plans and schemes that could be used as artifact models. Only one cultural model was made. Because of time-pressure there was no time to first make empirical models and then 'consolidate' as it is termed in CD, and instead the empirical observations were often generalized on the spot. The focus on plans and schemes that formed the basis for artifact models came naturally from the kind of healthcare support the team was about to develop. The sole focus on flow models, however, needs some explanation. No doubt the flow models are the ones within CD that most broadly describe the relations between persons, artifacts and acts and therefore most relevant to the team. While the physical models do not seem immediately relevant to the product they were to develop, the absence of sequential and cultural models could be a restraint. There is a kind of sequentiality in the prose descriptions of the work process that follows each model, but sequence models as such were not made. At one point, the team began to put numbers on the arrows leading from 'roles' to 'artifacts' in the model in order to overview this process, but this was not done in other cases, since it was not in line with how the flow modeling of CD is described. The absence of cultural models can in part be justified by the relatively clear division of work between physicians and nurses.

The primary benefits of the field-trips and the follow-up sessions were the first-hand experience of hospital work, the factual knowledge gained, the sharing of knowledge with other team members and a gradual overview of work-processes of clinicians. Tacit knowledge at which CD also aims at capturing was not elicited. The short duration of the single visits, recourse to explanations by the firm's clinicians and possibly a pre-conceptualization by the checklist worked against this.

At the vision-workshop, the intent to let clinicians construct the user interface of the future health care system through paper mock-ups of screen pictures was only partially successful since the clinicians were more prone to engage in discussion than to design with the pencils and notepapers provided. Instead the developers themselves often took the initiative to draw out ideas suggested by the clinicians and as the workshops proceeded they began to prepare paper mock-ups that fitted to the scenario in question and from which the clinicians could go on.

However, the numerous discussions at the workshops did provide a check on and deepening of the knowledge gained during the fieldtrips, suggestions for the design of the new health care system and pointed at what the user requirements should include.

DISCUSSION

There is neither in ethnography nor probably in system development a recipe that will fit all projects and contexts. Probing into other worlds, cultures or professions is a situated process where initial focus, methodology and plans might have to be revised in context. The developer-researcher-designers have to be seen as "self-organizing systems with constructive as well as reflective skills." (Löfgren & Stolterman 1999:14) and not as actors executing prescribed methods or plans. This is reflected in the selective use by EF of CD, and this is, I suggest, what made them work around the difficulties inherent in CD.

As previously stated, EF had employed a nurse and a laboratorian that helped the team with their information gathering process. This enabled knowledge of central clinical terms and a rather close focus on what which parts of health work was deemed relevant for the team's product. The nurse and the laboratorian thus provided a means of bridging the team's gap of knowledge as did the continuous contact and close cooperation between the team manager and the physician that was the contractors representative. CI on the other hand provided the team with first hand knowledge of health care at hospitals and with more detail on the relevant work processes. The knowledge from the information gathering phase was seen as valuable by the team, but equally so was the self-experience of what hospitals were like. Depth and detail of knowledge about hospital work was gained mainly through the vision-workshop and the discussions that came up here. While many ideas were conceived at this phase for the future system, little design itself was made by the use of the card-box mock-ups. This was mainly done in the iterative, fourth phase of system development at EF. Because of time pressure there was little time for in-depth fieldwork, careful generation of generalized models of work from empirical models nor any kind of analysis other than the implicit reflections it involved to construct these models and prepare the card-box mock-up workshops.

The team itself considers CI a valuable tool because of the emphasis on fieldtrips and the knowledge sharing that took place at the interpretation sessions that followed each field-day. They do not see the need for an ethnographer in this process and object to this idea, because they fear that this would deprive them of exactly the first hand experience and knowledge sharing that they found useful. They are willing to experiment with a different combination of field- and interpretation-days, but in general found CI useful. The case of EF apparently suggests a rather meager role for ethnography in design. What is needed in design is apparently an ease-to-use ethnographic.toolkit.

However, while first-hand experience and self-constructed overviews through the work models of CD are without question valuable, I would argue that the team could work around the weak points of CD because of the combination of approaches they applied. The engagement of a nurse and laboratorian and the close, continuous contact with a physician probably helped them overcome the limitations of short field work: low-depth information, risk of preconceptualisation and lack of analysis. While a meager kind of knowledge transfer as inherent in CD is workable, as the case of EF suggests, this case also suggests that prolonged user-contact is central and that more ethnographic knowledge can usefully be employed: e.g. ethnographic reflections on how to engaged with informants; examples of how preconceptualisation continue to pop up; and examples of how work processes can be analyzed from different points of view. This could enrich the information gathering process of designers.

This is but one case that looks at the use of ethnography in design. Basically, we need more analysis and reflections on such in order to access what kind of knowledge developers need and how ethnography can be applied to provide it.

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Contextual Workshops: User Participation in the Evaluation of Future Concepts

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ABSTRACT

Involving the users in the design process in order to understand their current situation and to generate new ideas for the development of future products and services is highly relevant to achieve a good result. There are several Participatory Design activities available for generating new ideas and concepts. There are also several activities available for the development of specific concepts and ideas. However, there are few if any activities available that address the choice of which concepts and ideas that should be further developed when there are several alternatives.

In this paper we present an activity designed for this purpose: Contextual Workshop. The activity uses visual presentations of ideas and concepts as a basis for focus group meetings with presumptive users. Furthermore the focus groups consist of members who already know each other and the workshops are conducted in the context of use for the presented ideas and concepts. Several advantages but also drawbacks with the activity Contextual Workshops are possible to identify and these are also discussed in this paper.

Keywords

user participation, concept evaluation, context of use, focus group, affinity diagram.

INTRODUCTION

Participatory Design is founded on democratic values and has been used in user-centered system development since 1970s [6]. In order to develop new ideas and concepts, information from different sources should be collected, for instance from market research and field studies of the intended situations [15]. The term concept is used here to represent an idea not elaborated in details; it could be a vague idea about a whole system (e.g. a connected home), a suggestion for a service (e.g. remote control a sauna in the connected home from the mobile phone), or a new use of an interaction technique (e.g. voice interaction with an electronic TV program guide). However, developing systems for the future by involving users in the design process is a complex task that can be conducted using various activities. Function Analysis is one such method used to discover what future features, products and services (hereafter referred to simply as products) should do but not how they should be implemented, e.g. what functions they should provide [13]. Another activity is Future Workshop that supports the generation of visions of future use in a specific area [11]. Many of the activities are used either in the beginning of the design process (e.g. to investigate the market and generate new ideas) or during the development of a specific idea when a prototype is available (e.g. to evaluate the product). Involving the users from the beginning of the design process when no prototypes have been developed demands a good understanding of the context of product use [17]. As a consequence, there is also a need for activities that involves users in the evaluation of new concepts to choose one or a few for further development.

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In this paper, we present the activity Contextual Workshop that has been developed and used to get information about users' expectations, reactions, and attitudes towards future ideas and concepts concerning future products. Contextual Workshops involve users in the early phase of the design process through workshops conducted in the context of use, such as the home environment, and with a group of people that know each other, such as a family. The activity is based on discussions where visual presentations of ideas act as sources of inspiration as well as boundaries for the discussions. These presentations describe various scenarios of use.

BACKGROUND

Participatory Design should be seen as a whole set of activities with the common purpose of involving the user actively in the design process and of emphasizing the importance of context of use. When working with this approach, we needed some kind of activity to get user feedback into the concept evaluation phase as well. Inspired by other Participatory Design activities such as Future Workshop [11] and Cooperative Prototyping [5] we developed Contextual Workshop as an activity that lets the users get involved in the very critical phase in the design process where decisions about what concepts and ideas to continue to develop, must be taken.

The activity Contextual Workshop was developed and evaluated in the framework of the European project InHoMNet about the Connected Home [10] that Nokia Home Communications was a member of. The aim of the project was to connect appliances (such as a TV, a Set Top Box, and a home controller) in the home environment with the purpose of building a platform to a networked home, the connected home. Contextual Workshop was used to involve the user in the concept evaluation phase of the design process in order to explore the users' needs and attitudes towards the connected home. In the study, the ideas and concepts were presented for the families as 12 storyboards. The workshop took place in their own home environment, e.g. in their kitchen. Six workshops were conducted by two designers, one acted as a moderator and the other was responsible for note taking.

The creative design could be seen as an exploration of the design space in a divergence phase and in a convergence phase [14]. There are different ways of involving the users in this process. Before starting the divergence phase, information about the users and the market is collected for instance, by conducting ethnographical studies and market research. In the divergence phase the design space is explored with the purpose to generate ideas. A common view in Participatory Design that is important to emphasize is the *meaning* of the users' participation; they are not just a source of information, they are potential inventors [7]. The convergence phase starts with the aim of evaluating the number of ideas generated in the previous phase, the designers must decide what ideas to develop further. Contextual Workshop is an activity that involves the users in this step as well. Later in the convergence phase the users can be involved in for example evaluations with simple paper mock-ups or Cooperative Interactive Storyboard Prototyping [16]. In the end of the convergence phase, when the exploration of the design space is almost done and the designers know more about what ideas to develop, the actual use can be studied further when the users interact with more advanced prototypes.

CONTEXTUAL WORKSHOPS, CW

Contextual Workshops (CW) is based on workshops with users in the context of use (of future products) by conducting focus group meetings guided by visual presentations of ideas. Visual presentations can be among other thing storyboards, paintings, animations, and video clips. CW is aimed at involving users early in the convergence phase of the design process when new ideas need to be explored and evaluated. Using CW, several ideas can be tested at the same time. Context understanding is important through the whole development process [17] and therefor the evaluations should take place in the context of the presumptive use.

The definition of the term context that we have used here is: "a description of a complex situation that an individual finds herself in." The term includes the physical environment, the people being there, the social interaction, the culture, the atmosphere, and other features that surround and create the actual situation – the context. It is very important that the usage context is defined in the scope of the idea description as well as the product's functionality, the intended users and their goals with the use of the product. CW is one way to come closer to such a description.

CW is based on focus groups conducted with an already established user group (e.g. a family) in the context the product is intended for (e.g. a home environment). The focus group method is a comprehensive research method that is used to collect data through structured and controlled group interviews [20]. The method is flexible and changes according to the purpose and the environment. Hackos and Redish [8] (among others) have criticized focus groups. One critique is that it often does not include real users but gatekeepers such as supervisors, managers, and others who made decisions about the products. Another critique is that it is not conducted in the users' environment. Using focus groups with real users in the context of use helps to avoid the risks mentioned above.

In a focus group session it happens that the group tend to compromise a lot, in a way that makes their decisions always ending up in some kind of no-man's-land; *conformity* ([4]; [19]). The decision the group takes is actually something no member in the group can stand behind. This is common in groups of people that do not know each other that well; everybody wants to be polite. It is also common when the group members have different experience of the topic for the discussion. In order to avoid this risk, CW involves groups where the group members know each other very well – like a family. It could also happen that the group, if they don't have that much experience of the subject under discussion, start to take decisions that are much more extreme than the group members would express if they had been interviewed alone, this is known as *polarization* ([4]; [19]). This is simple to avoid if the focus group is used only to get hold of the participants' opinions and not forcing them to take decisions that should be representative for the group. In CW the group members do not take any decisions, they just discuss various situations and scenarios.

To communicate the concepts, the designers illustrate the situations and scenarios in visual presentations. These are made so that the whole group can get hold of the content at the same time. If there are text as well, someone in the group reads for the others (like a storyteller). In this way, the designers' communication language for expressing the concepts is visual, textual, and oral.

A good system design is achieved by involving those who are responsible for design decisions in the collection and interpretation of information with regards to users in the intended context of use [1]. Therefore, the workshops should be prepared, conducted, and analyzed by the designers themselves. As a consequence, the designer need to be skilled in understanding the user's language since language is the user's tool used to communicate thoughts, opinions, ideas, needs and so on. Understanding the user's language is therefore very important in the CW as it also contributes to the process of developing a common language for the users' and the designers' work together.

Workshop Procedure

A workshop consists of four sessions: an introduction session, a practical session, a brainstorming session, and a discussion session. The practical session is conducted as a focus group meeting.

The workshops are led by a team consisting of a moderator and an assistant. The team should be skilled in interview technique and picking up among other thing attitudes, new ideas, advantages, and problems with existing products. The moderator runs the workshop while the assistant observes the users, makes notes, documents the discussions, and helps with practical issues. During the workshop, the moderator makes sure that no person in the group dominates the discussion and steers the discussion when it goes outside of the area of interest. However, since the group members already know each other and every member has a role that should be taken into account, e.g. the children in a family could be very talkative by their nature. The natural behavior is important to respect and must be maintained as much as possible. To make sure that all the users' opinions are captured, the practical and discussion sessions are tape-recorded.

The workshop starts with an introduction session when the workshop leaders and the users present themselves for each other. As laugher is an icebreaker, the next part is about doing some short but funny exercises, e.g. doing some drawings. The workshop leaders also participate in the exercises. The purpose of the exercises is to create a relaxed atmosphere and to bring the users and the workshop leaders closer.

After the drawing and laughing, the practical session starts. The visual presentations are used in this session. The users go through the presentations one at the time, give comments on them, and discuss them. The moderator is passive as long as the users have something to say and the subject under discussion keeps on track. The moderator starts to ask follow-up questions when the users do not have more to say and the moderate would like to get more information.

During the brainstorming session the users use their imagination and imagine that the services, concepts, and ideas in the visual presentations are available to them in real life. After that, they write down their opinions and thoughts about them on sticky notes, one opinion on each note. Then, the users are asked to organize the notes in clusters and to label them with appropriate headlines. The purpose of doing this is to get closer to the users' thoughts, ways of thinking, and opinions.

The brainstorming session is followed with a discussion whose purpose is to summarize the two previous sessions. In this way, the moderator makes sure that everything is captured and the users have an opportunity to add something if they want to.

Data Analysis

The designers who are in charge of the workshop (both the moderator and the assistant) should analyze the data collected during the workshop. All the data should be included in the analysis process: the assistant's notes, the users' sticky notes, and the tape recordings. Before starting the analysis, all the data should be transcribed. After that, for each group the material is analyzed in two different ways, this is done as a co-work between the two designers.

First, the transcription material is divided under the following headings: positive, negative, questions and suggestions. Thus, the users' attitudes, both negative and positive, are identified as well as new ideas and concepts are captured. The designers do not communicate with each other at the beginning when they go through the material. When they have gone through all the material they go through each heading cluster together (positive, negative, questions, and suggestions). Consequently, they have the possibility to reorganize the material in the clusters and duplicate some of the material. After that, the clusters are documented.

Second, the transcription material is mixed together and then a new dividing is done. At the same way as in the previous step, the designers go through the material in silent first and then they go through the clusters together. By doing this new groups and headings will hopefully appear. The designers together label the clusters with headings that are characteristic for each cluster.

The last step is to make an affinity diagram for each participant group and heading. Affinity diagrams are included in several design methods such as Contextual Design [3]. A designer team uses affinity diagrams to bring the team together, share the data, and interpret the data in agreement. The purpose of the diagram for our design team (the moderator and the assistant) is to develop a common interpretation of the data. Since the designers themselves conduct the workshops, the data analysis process is affected by their understanding of the group. This understanding helps the designer to interpret the users' comments, utterances, and contributions.

DISCUSSION

There are several advantages and also some drawbacks with CW that it is important to be aware of.

Advantages

The advantages of using CW are among other things based on the form of the procedure.

Concept Evaluation

The workshops provide data about the users' attitudes, users' preferences, and qualities in use. As a result, the designers get feedback on concept level, on function level and on design level.

Effectiveness

Since the workshops are conducted in groups, more data can be collected in the same amount of time as in methods based on individual participation. This advantage is characteristic for methods where data is collected using qualitative methods conducted in groups such as focus groups. Moreover, group discussion can generate new ideas because when a person starts talking about an idea, it can trigger associations, thoughts, and ideas in other people.

User and Context Understanding

An advantage of the method is to begin to understand the user and the context of use in the very beginning of the convergence phase of the design process, when ideas exist but need to be explored and evaluated by the users. Conducting the workshops in the context of use helps the designer to better understand the users. By visiting families in their residence for example, the designer observes the home and the technology of the home. This understanding is an important resource when analyzing the data.

Use of the Context

Conducting workshops in the context of intended use helps users make use of the current situation to express their need in the future as they can refer to things in the existing environment. However, the context also helps users to generate new thoughts or ideas, which is not the primary purpose of CW but which may be regarded as a positive side effect. For example, if a workshop is conducted in the users' home, the user looks around and sees her cookbook and that gives her a new idea. Another advantage of being in the context of use is that the user has the opportunity to evaluate new ideas at once. For example, if the idea is about using an electronic notice board, the user can look around and think where to place such a device.

Designer Introspection

The method gives the opportunity for designer introspection. The workshops assist the designer in reflecting about the interaction between the design, the users, and the context in a way they can not do by their own.

Well Established Group

As the group members already know each other, workshops are conducted in a more relaxed atmosphere. One of the drawbacks of building a group of people who do not know each other is that they are not comfortable with each other which effects the discussion and consequently the collected data.

Disadvantages

CW has some limitations that it is important to reflect about before and after the workshop is conducted.

Data Collection

The first disadvantage of the method concerns the kind of the data that can be collected. Because no specific prototype is employed in the method, designers do not obtain information about presumptive use. The interaction that is studied is based on what the participants believe they would do and not on an interaction with an existent system. Therefore, the workshops do not show behavior since people do not report on what they really experience.

Choice of Participants

Another disadvantage is a limitation in possible workshop participants, which is a general problem to most Participatory Design methods and not specifically problematic for CW. Participants must be representative product users and they should not be decision-makers in the design process.

Group Dynamic

The dynamic of the group could affect the participants negatively. In the presence of people with dominant personalities there is a risk that their opinion affects the rest of the group and consequently the discussion would take another form than it would have in another group constellation. If the group members do not know each other that well, there are also risks for polarization and conformity.

Scenarios

The scenarios used in the methods are generated to illustrate new ideas and concepts of various situations of importance for the context of use. The choice of these scenarios is important for the results since the purpose is to help the user to imagine a situation. The choice of these scenarios is not easy as there is always a risk that the scenarios may be considered inappropriate for some users. The choice of the scenarios should be based on user information collected by other methods, such as market research and field studies.

CONCLUSION

Using CW, several ideas and concepts can be evaluated at the same time with the users in the context of use. It is important to note that data gained by this method is mainly about the users' expectations and attitudes and not about the actual presumptive use.

However, CW can contribute to the convergence phase of the design process in four different ways: (a) the understanding of the user and the context of use that is a crucial ingredient in the design process of developing usable products, (b) the possibility to get insight in the users' attitudes towards ideas and concepts early in the design process, (c) the insight about the possible areas of use regarding the ideas and concepts, (d) the qualities in use that are important to the users.

These contributions help the designer in the important task to select which concepts and ideas generated in the divergence phase that should be developed further.

WORK FOR THE FUTURE

An interesting work for the future is investigating the influence of the visual presentation on the data generation. Therefore, the method should be tried with other visual presentations such as video clips or animations. Another interesting work for the future is using the method in another context such as a work context. The relationships between a group of people who work with each other are not the same as between family members. It would be interesting to investigate how the kind of group relationship influences the data.

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Design for Dummies – Understanding Design Work in Virtual Workspaces

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ABSTRACT
New IT artifacts and new ways of designing artifacts challenges the common distinction between design and use. The extensive use of general packaged software changes the conditions under which users influence the design process of the IT artifact. We report from a longitudinal case study of the introduction and use of a packaged web-based groupware product in a financial services corporation. The case study is based both on interviews, a questionnaire and http-log analysis. Our case study suggests that we need to extend our understanding of IS-design as something that continues in what we usually call the use situation. We propose to define this activity as *end-user design*, and argue for the usefulness of the concept, drawing on Wanda Orlikowskis notion of technology-in-practice.

Keywords
Design theory, use, Virtual workspaces, organizational communication, end-user design.

INTRODUCTION
A common distinction in software design as in design in general is that between *design* and *use*. Designer design and users use. However, one of the crucial specialist competencies needed to design software is that of the users. This introduction of users in the design process has again blurred the distinction between what we should characterize as *design* and *use*.

There is a large body of literature in which the relationship between *design* and *use* is examined critically (Schön, 1983; Norman 88; Nardi 1993). Even though design is used in a number of different senses, software design is considered an activity initiated and controlled by professional designers and programmers. These professionals then involve users in different ways and degrees.

The involvement of users in design is challenged in the design of packaged software. This is due to the distance in time and space between the development of the software and the use situation. We suggest that re-thinking the distinction between design and use might help researchers and designers of packaged software. This includes introducing *end-user design*. Then we can think of packaged IT-development as *designing for end-user design*, which can be a conceptual support for ensuring participatory design in packaged software development.

Bringing use to the design situation or bringing design to the use situation
One of the solutions to meet the challenges to software development is the active involvement of users. This is being emphasized by both the CSCW and PD research communities. One of the interesting concepts for engaging users is that of tailoring. Current research in collaborative tailoring is carried out by e.g. (Teege 2000) and (Mørch & Mehandiev 2000).

Over the year's concepts like prototyping (Floyd 1992), tailoring (Trigg 1987) and bricolage (Bucher, Mogensen, Sharpio 2001) has been introduced in order to describe or define the design process with user participation. The users participation has for the most part been limited to users participating in the development process. An exception is Bonnie Nardis visions of the end-user making alterations by high level programming (Nardi 1993). But end-users making alterations on the programming level

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has not become a success. Specialists in work practice cannot also be specialists of high-level programming.

DISTINCTION OF END-USER DESIGN

The point of departure for the research presented in the following is a change from a context where the designer co-designs with the user. We have studied the users continuations of the design process in what is usually referred to as the use-situation.

This leads us to suggest the introduction of the concept of *end-user design*. While tailoring would seem like a natural candidate, we find it problematic in our context of packaged software. Tailoring is normally conceived as clothing being uniquely designed by tailors to fit certain customers. This is not what we observe studying packaged products like virtual workspaces, which is the object of our case study. Virtual workspaces are more like off-the-peg clothes, trimmed by the users, not to fit the needs of the individual, but to fit the co-workers and their shared praxis. Moreover, research in tailoring is primarily concerned with the internal complexity of an artifact and the complexity of the tailoring mechanisms. We are more concerned with the complexities between the artifact, which in our case is a virtual workspace and the environment, which we refer to as a work practice.

DEFINING END-USER DESIGN

Before documenting end-user design empirically we need a definition of what we mean by end-user design from a conceptual standpoint.

We think that Orlikowski's application of structuration theory has done a great deal of the definitional preparations for defining the concept of end-user design, and we shall use her concept of technology-in-practice as our outset.

Orlikowski argues that we should draw a distinction between the technology as artifact, and the technology-in-practice. What happens in the use situation is that users interact with some properties of the technology at hand (ignoring most of them) and in this interaction create and recreate the social structures that constitute work. “These enacted structures of technology use, which I term *technologies-in-practice*, are the sets of rules and resources that are (re) constituted in people’s recurrent engagement with the technologies at hand.” (Orlikowski 1999 p. 407)

While users interact with some of the properties of the IT artifact, they do not interact with all of them, nor can the designer predict which properties. We find this conceptual distinction between the technology as artifact and the technology-in-practice a proper description of what we have seen empirically in our study of virtual workspaces. The use of virtual workspaces in our empirical case shows diversity in use as well as a very selective choice of which functionality to use.

Using Orlikowskis distinction between the IT artifact and the technology-in-practice we define end-user design as:

The collaborative establishment of the social practice of use (technology-in-practice) as well as the change of system features by users (technology as artifact). End-user design is performed by the users in the use situation. It is typically not temporally nor organizationally separated from use.

One example of end-user design is the negotiation, decision and implementation of a folder structure in a virtual workspace. Another example is the process of agreeing and implementing the use of a virtual workspace for distributing meeting minutes in a project.

INVESTIGATING END-USER DESIGN

We introduce virtual workspaces as the empirical example of why the existing division between design and use is becoming blurred and why we suggest to introduce end-user design to capture what we see as an overlooked aspect of the design process..

Virtual workspaces are packaged groupware applications that support collaboration among a group of people. They are based on Internet technology and are often available as an ASP service on the Internet.

Our argument for the introduction of end-user design is based on empirical investigations of virtual workspaces. The data are derived from a longitudinal case study of the introduction and use of Lotus Quickplace in a multi-national financial corporation. Lotus Quickplace is a packaged virtual workspace product marketed by IBM, which was introduced in the organization to support distributed collaboration. Lotus Quickplace, as are other virtual workspaces, is a fairly simple technology that allows sharing and structuring of documents, simple work-flow and integration with e-mail.

We studied the introduction and use of Lotus Quickplace using both quantitative and qualitative methods. The quantitative data are derived from a net survey, where 150 employees participated as well as analysis of the logging of the Quickplace usage. The qualitative data is based on observations and interviews. The log-files used is the http-log from the Quickplace server. The http-log stores each request to the Quickplace server with information about user, time of request, URL among other things. From the URL we have been able to extract information about which Quickplace and what kind of request the client has made. We were also able to extract the names of folders in the Quickplace from the URL. We use an analysis of the folders as an important indication of end-user design

We gathered our empirical data in the following way: The Quickplace technology was introduced in the corporation may 2000. In April 2001 we did 8 interviews. They were interviews with the responsible for the rollout of Quickplace, the Quickplace server administrator and the rest were with managers of selected Quickplaces,. Log-files have been retrieved, cleansed, stored and analyzed in a relational database in the period 5. May 2001 – 12. February 2002. The questionnaire was conducted in the period from 23. November 2001 – 11. December 2001.

In the period 4. October - 23. November 2001 up to the questionnaire there were 106 Quickplaces showing activity in the log files. 56 answers to the questionnaire were returned covering 45 of the 106 Quickplaces.

For the purpose of this paper we have selected three exemplars of how Quickplace is used in the organization. The categorization of Quickplace underlying our exemplars are derived from interviews and confirmed in the questionnaire. The three exemplars are: organizational unit, project, and recurrent task.

Our approach to studying end-user design has been a somewhat archeological approach. We have not studied end-user design directly by observation. We have rather found traces of design activity as well as some limited descriptions of the design processes derived from the questionnaire and interviews. The log files and studies of the folder structures in the Quickplaces derived from the log-files have been our primary sources for collecting "traces" of design activity.

VIRTUAL WORKSPACES IN A FINANCIAL SERVICES CORPORATION

The multi-national financial services corporation studied was created as the result of a merger between three financial services companies announced in March 2000. Lotus Quickplace was introduced in the organization in May 2000 as a tool to support the projects that should merge the three companies. It has turned out, as our exemplars illustrate, that it is being used for very diverse purposes - and for purposes other than the intended

The technology was introduced without any implementation or educational effort. The announcement of the availability has been selected e-mails and word-of-mouth.

The process for getting a Quickplace consists of sending an e-mail to the security department and ask for them to set up a Quickplace with some named managers responsible for the room. The business justification was that people from more than one country had to work together. The concept of manager used here is taken from Quickplace, where the manager is a user with rights to e.g. invite members and change folder structures. Some of the Quickplace managers are real life managers, while others only have the “privilege” in the Quickplace.

Quickplace is introduced in the organization as another communication technology. The existing technologies available, which all our respondents were using, were: e-mail, telephones, Intranet and LAN drives.

1. Org. unit

The presentation of this Quickplace is based on two answers to the questionnaire and analysis of log files. The Quickplace was initialized 18. August 2000 and has been running for app. 15 months at the time of the survey.

An organizational unit in the corporate institutional banking division uses our first exemplar. Corporate Institutional Banking serves large corporations and institutional customers and this organizational unit serves customers in 13 different countries where the bank is represented. The unit was formed at the time of the merger by combining the similar units in the pre-merger banks. The unit has started a Quickplace to support a number of communication processes. They use it for exchanging marketing material, as a working directory for communication to e.g. customers and for maintaining the holiday lists.

An important part of the units work is to issue loans to customers. For this work they use the Quickplace in several ways. The Quickplace is used to store approved credit limits, guidelines for issuing loans and as an information repository for ongoing credit projects.

2. Recurrent Task

This Quickplace is based on an interview with the manager, one answer to the questionnaire and log-analysis. The Quickplace was initialized 17. May 2000

The Recurrent Task Quickplace is used by the translator unit in the communications department. The translators use it as a tool to coordinate the translation of three different recurrent translation tasks: The translation of the quarterly and annual reports, the company magazine, and press releases. All of these documents are translated to the four Nordic languages and in English.

The translation process of the quarterly and annual reports is a very time critical task and the translation process actually begins before the report is completed in English. The translation is thus partly running in parallel with the completion of the report. This produces a situation where there is a need for tight coordination and version management. The Quickplace is used to support this coordination and version management.

3. Project

This Quickplace is based on an interview with the manager, one answer to the questionnaire and log-analysis. The Quickplace was initialized on 15. November 2000.

The Project Quickplace is supporting an IT infrastructure project. The purpose of the project is to build a security infrastructure that should result in all customers having just one ID when doing various electronic business with the bank.

The Quickplace is used by the members of the project as well as an extended team of affected units in the corporation, including other infrastructure projects running in parallel. It is used as a shared document repository for e.g. meeting minutes, decision material, presentations, and solution documentation for both the IT-solution and the business processes.

This initial brief description of our three exemplars should serve to illustrate the diversity of uses. The same simple tool is being used in quite different ways to serve different purposes in the organization. Without any centralized implementation and educational effort different work practices have evolved with the Quickplace technology. In Orlikowskis words, three different technologies-in-practice have emerged in our three exemplars.

Both the org. unit, the recurrent task and the project Quickplace have established new work practices or redefined existing ones using Quickplace as an integrated part of the practice. This establishment of work practices indicates to us, that some interesting collaborative activity has taken place to define this new work practice and integrate it with Quickplace. It is this activity we would like to refer to as end-user design.

According to our definition of end-user design, it integrates both the establishment of a new work practice and the change of properties of the IT artifact. While our brief description indicate the establishment of new work practices we still need to see how this is integrated with changes to the IT artifact.

One typical change that is made to a virtual workspace as well as most groupware products when establishing a work practice around it, is the structuring of documents in different folders. We document the second half of end-user design by looking at folder structures of the three exemplars as well as descriptions of the process of establishing the folder structure taken from the questionnaire.

In order to show the different design processes that have taken place we describe both the process and the product of the design process. The product of the design process is provided with the naming and organization of the folders in the three Quickplaces and how they have developed over time. The process is documented as descriptions taken from users who have answered the survey.

All Quickplaces are by default provided with a folder structure. The intended purpose of the folder structure is pretty self-explanatory: it is designed to provide basic functionality for people working together in some kind of group.

This initial folder structure has evolved into three very different structures. While some of the default folders were maintained, the overall impression is very different.

Default Folder structure:
Welcome Library Discussion Calendar Index Tasks Members Customize

While the default folder structure is only one-level deep, Lotus Quickplace allows the creation of sub-folders or "sub-rooms" and this has been exploited in all three cases. The existence of sub-folders is indicated by a ":". We have decided to show only the top level in order to save space.

The analysis of the folder structure is taken from the http log. This has enabled us to see the change of the folder structure over time. The observation of the folder structures over time shows some interesting developments including gradually increasing complexity and then in some cases sudden simplifications. While we have chosen to simplify our exhibit for the sake of the present argument, this indicate a continuous rethinking of the folder structure and thus also a continuous rethinking of the work process over time.

If we take a look at the organizing principles for the three Quickplaces, they are not surprisingly quite diverse.

The acronym names of the folders in the org. unit refer to sub-groups dealing with different markets and problems.

Org. Unit 4/10 2001
Welcome Members Customize Index TEST ROOM EMF: Library: FIIC: GFI: EM - 3: EM - 2: EM - 1: CBRM:

While the org. unit has a folder structure that is organized along with the organization, the recurrent task is not surprisingly organized after these tasks. As said, the three tasks that are coordinated in this Quickplace are quarterly and annual reports, press releases and "Nordic Ideas" the magazine.

The history of the folder structure, which is not documented here also shows a difference in how they evolve. The folder structure in the Org. Unit shows a gradual increase in complexity and then a sudden simplification indicating a major re-organization. The folder structure of the Recurrent Task shows a continuous change that follows the recurrence of tasks along with the pattern of gradual increase in complexity and sudden re-organization.

The folder structure changes in particular with the recurrence of the financial reports. The folder structure pictured here is taken in the period between the translations of financial reports. While the financial reports are translated, another folder structure is used temporally. The two latest reports "Q4 2000" and "Q2 2001" are kept as an archive. Apart from most of the Quickplaces we have analyzed, a lot of documents are deleted from this Quickplace. This is explained by the recurrent task function. When the translation of a financial report is finished, only the final version is of interest.

The folder structure of the Project Quickplace is a mixture of categories both made according to audience as "Steering Group docs", sub-unit in the project like "Business processes" or document type like "Use case room".

Also the Project room has changed considerably over time as the project entered different phases. The "Pre-study room" folder is actually an archive of what was once the purpose of the whole Quickplace. As all projects in the corporation a project is always started up as a pre-study to analyze the benefits, costs and risks of doing the project. As the project pre-study was finished and budget was given to start the project, the Quickplace grew into a Quickplace for the project and the pre-study material was filed in an archive folder.

Indications of end-user design

What these cases indicate is that the members of the Quickplace has been engaged in a process we would like to refer to as end-user design. The different specific tasks the Quickplace is helping to accomplish has been designed by the members. The different folder structures document the changes to the artifact.

The actual design process that has resulted in the folder structures exhibited above has differed according to the answers provided in the questionnaire and from interviews with the manager of both the Recurrent Task and Project Quickplace.

The Org. Unit has organized the design of the folder structure in a workshop, where the strategy for using the Quickplace was agreed. Also, the interfacing of Quickplace with other available media like e-mail and Intranet was discussed. Individuals do minor changes to the structures without requiring workshops.

The recurrent task Quickplace has one manager of the Quickplace who decides on the structure of the Quickplace. She does consult the other translators, but she does the structuring and tells the members how to use it properly.

The Project Quickplace organized the Quickplace after a principle of delegation. The overall project manager of the project decides on the level one structure while the responsible people for sub-projects like e.g. defining and implementing "Business processes" structure the sub-rooms.

The three design processes can be analytically separated in two parts:

1. The establishment of a new work practice like e.g. translating an annual report using the Quickplace
2. The design of the folder structure to support the work practice

We have only limited knowledge of how 1. has actually happened. Our interviews shows a mixture of different kinds. On the one end is very explicit design activity carried out collaboratively in workshops. Or individuals who design the work practice and then tell others to do things according to the design. On the other end work practices seems to emerge less explicit and seems rather as habits like we know from using e.g. e-mail.

Even though we can analytically separate the two activities, they are in practice tightly integrated. Orlikowskis concept of technology-in-practice focuses on the first part of the design process: the design of the new work practice. What we would like to emphasize is the integration of both the establishment of the work practice and the change of the IT artifact in what we suggest to refer to as end-user design.

Why call it design anyway?

The creation of folder structures that form the basis for our argument would probably be characterized as a trivial task in terms of the internal complexity of the IT artifact. It is a well known aspect of end-user computing at least since the PC. Rather than see the folder structures as a trivial task in terms of computing, it should be seen as traces of a very interesting collaborative design activity. When we triangulate the folder structure with the questionnaire and the activity in the Quickplace documented in the log files, it is clear that the end-user design, as we propose to call it, is a complex activity. And it is an activity that is at least as crucial to the successful use as is the properties of the IT artifact.

Rather than discussing the complexity or depth of the changes to the IT artifact in e.g. configuration files or source code, we would like to turn the attention to the complexity of the relation between changing the artifact and changing the work practice.

The reason we insist on referring to end-user design is two-fold. Firstly, we would like to emphasize that changes are made to the artifact in the process of creating the technology-in-practice. Secondly, we would also like to emphasize the importance of the actual process leading to the technology-in-practice.

IMPLICATIONS

In this paper we have investigated a part of the design process for a virtual workspace.

Our case of folder structure changes might seem to trivial to be considered a design tasks. We think however, that the distinction between the internal complexity of the IT-artifact and the complexity of the relation between IT-artifact and the environment put forward by Alexander shed a different light on the problem.

Our hypothesis for further research based on the present case study is the following: Besides analyzing properties of IT artifacts and existing social structures, we suggest that design or end-user design be included as a key concept for understanding how certain use patterns emerge from the introduction of an IT artifact in a work practice. We suggest that users are not considered objects but are seen as agents in the design process.

We have not discussed explicitly the generality of our concept of end-user design. Our case study shows that end-user design makes sense in settings where:

- we are dealing with packaged IT-artifacts
- that are used collaboratively and
- where the functional specification is abstract in relation to the work practice it can support.

These criteria are e,g, typical for most groupware products. Investigations into the usefulness of the concept of end-user design in other settings however remains to be shown.

In the title of this paper we paraphrase the immense amount of "...for dummies" books available. We do this to deliver exactly the point of the book titles. This book is not for a dumb person, but for a non specialist in a field. What we have observed in our case study is design performed by users who are not specialists in the field of IT design.

The software development teams behind packaged software can only predict in which organizational contexts their product will be used. In that perspective, the end-users are the real specialists of the work practice. Therefore we suggest that the developers of packaged groupware software think of themselves as *designers for end-user design*. This is a new way of conceiving the idea of participatory design in the era of packaged software, and we believe that supporting *end-user design* in the software is a promising direction for both researchers and practitioners.

CONCLUSION

The present paper has studied empirically how an IT-artifact is being integrated into different work practices. In a context of packaged software - perhaps where we would least expect it- we have observed user-centered design. Actually we have observed something more. The design is not only centered on the user, the users are actually doing a significant portion of the design. To capture this we propose the concept of end-user design.

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ART/WORK STRAND

PDC 2002 ART/WORK EXPO

The Participatory Design Conference 2002 Art/Work strand (theme: Participation and Design) includes an expo exhibiting artwork created as part of a research process. Each exhibit is accompanied by a 3-page paper, addressing the questions:

- To what extent can Art be participatory?
- Where is the border between Art and Design?

Practice-based research in art and design has grown increasingly with the development of digital tools and media. Can it create artistic work whose aesthetics and originality place it in the same league as pieces produced primarily to demonstrate creative talent, qualifications and skill (as in graduation or design doctorate show material), or work intended purely for exhibition or cultural production? Should it aim to do so?

As well as interrogating the place of Art/Design in practice-based research, the Art/Work strand is designed to provoke fruitful discussion of cross-discipline endeavour and research funding structures in the art/design environment.

Exhibits range from tangible interface-based interactive products through augmented space and distributed 'conversational' narrative installations - factual, architectural and fictional - to digital hypermovie, children's interactive play, and constructible avatars. Some of the exhibits represent participatory artwork as such, while others demonstrate the participation of art and artists in a research and design process of which the exhibit is an outcome but not necessarily the final goal. Some exhibits participatory activity to tradition in the context of the evolving practice of the 21st century, stretching the borders of the term 'participation' to include and highlight personal interactions with or through art and design, individual development, and active or collaborative 'performance' including artefacts.

The Art/Work Expo is designed to run in the exhibition space for the duration of the conference, and in addition each exhibitor will give a short paper to the conference participants on their work. The exhibits will also serve as the focus for a round-table discussion: *Spatiality and Conversation as Models for Design/Art*, around art as process, collaborative authorship, and interactivity.

MOVING STORIES

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ABSTRACT
Today, designing for home environments call for new design approaches, which are able to more fully embrace the complexity of modern living. The preliminary methodological 'thesis' of Moving Stories is that the interrogation of spaces of experience and reflection, of *lifeworlds*, require design approaches and forms of representations that are likewise experiential and reflective. In the *Moving Stories* project ethnographically inspired methods were mixed with artistic ways of working, as an alternative way of organizing and representing the design process. The result includes a *video-installation* and a series of *booklets* with stories based upon material gathered from five households in the process of moving from one home to another. The participating researchers represented the three different professional fields of engineering, art and interaction design reflecting different perspectives on both methods and goals. The informants were at various stages in life, and the moves made them reflect upon different aspects of both time and space. Finally, the combinatory *installation* as a form of representation, is in this case not an attempt to make art, but an answer to the interdisciplinary field as well as to the manifold time-space of relocating — on the one hand an intermediary recess between the past and the future, on the other a space in formal transition.

Keywords
Design approaches, home environments, life world experiential space, intermediary space, ethnography, art and action research, installation as combinatory display.

THE HOME AS LIFEWORLD

Designing for home environments still seems to be a process defined from the point of view of technology, either in terms of rationalization or in terms of surveillance — a process often driven forward without the considering of the home as such.

Many IT designers experience this as a lack of methodologies for how to inquire into the role of information technology in home environments. Most often they are trained to design for work settings where the dominating approach can be characterized as 'finding and fixing problems', a system oriented approach aiming at predictability and efficiency.

We started of with a vague idea of the home as a deviation from what could be called rational space, as a *different* kind of space calling for a *different* approach. More than a functional space it should be treated as a personal space, defined from an individual and phenomenological point of view — a *lifeworld* rather than a *system*. Consequently, instead of defining problems we wanted to focus on specificities, on details, on the personal and perhaps even irrational, on the complex accumulation of experiences in and around the spaces we call home.

ART AND ACTION RESEARCH

The goal of our research therefore, is twofold. On the one hand we aim at developing methods of research better suited for the inquiry into spaces of experience and everyday life. This includes the appropriating of the forms of representing these experiential spaces in the design process, focusing on intermediary rather than demonstrative qualities. On the other hand there is a secondary goal of developing design visions for such a space as the home, visions with the capacity of broadening and augmenting different aspects of dwelling rather than the narrowing down of life to the level of problem solving and control.

Within an *action research* format [8] we apply a user-centered design approach engaging in a dialogue with participants/informants throughout the design projects [2, 4]. Crucial to this approach is the openness in the perception of space; the ability to grasp space, not as a fixed set of relations but as a space in transition, spaces as

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MOVING
STORIES


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temporary formations, as still undefined or vaguely defined, slight differences and changes, space as bodily experience etc. If the *lifeworld* could be understood as *"the totally of objects that can be known through experience"* [7], the home could be understood as a micro version of such a lifeworld. This phenomenological approach when extended to include also the design process as such, come closer to something that could be called an *artistic* method, due to its focusing on the experiential and individual.

In the case of *Moving Stories* this implied a stressing not only of a reflective and experiential approach to the *object of investigation* but also emphasizing a *self-reflection* in the design process as such [6]. Thus, the success of the action research depends on its ability to handle a situation where total openness is desirable but impossible, and in such a situation art can provide the means for staging a dialogue that contains its own critique.

This is the reason for our emphasizing the setting up of temporary spaces of experience, or *temporary design labs*, where stakeholders — like potential future users/dwellers and R&D representatives from the industry — take part in inquiry and design on a collaborative basis. The aim is that they participate in a series of workshops, and that these are central in the further development of the project [1, 2, 3, 4, 5]. We mean that the workshops should be understood as more than an occasion of feedback, but as *intermediary spaces of experience*, each one to be temporary furnished and explored.

THE MOVING STORIES PROJECT

Our interest for the home environment derives both from its format as a conceivable experiential unit, a space with a scale related to the human body, and to the fact that the home is a space that reflects the broader transitions of modern society. This was also the reason why we, in the "Moving Stories" project, chose to follow people moving from one home to another, people in the process of de- and reconstructing their homes, thereby reflecting over the different aspects of dwelling and the different components of a home.

Five different households participated in the project. Their stories were recorded on video from the point of packing, through the actual move, to the unpacking and furnishing of the new home. This documentation gave us an opportunity to learn more about the transformation of intimate space and of space as a situation where the past, the present and the future are brought together.

INSTALLATION AS COMBINATORY DISPLAY

The project was based on ethnographically inspired methods, which here signifies the collection of personal stories, where self-reflection and space construction are brought together in a video recording. We elaborated artistic ways of editing and representing, such as collages and combinatory displays (installations), where the artistic also could be regarded as an *intuitive* component. In a research situation *intuition* should be understood as a way of merging *our own experiences* of dwelling and relocating with the survey material. We mean that this is inevitable in all forms of re-presentation, but that it becomes more crucial in processes dealing with this kind of qualitative interpretation and evaluation of experiences. Thus, the final video installation, presented in the form of a moving container or packing box, was also an attempt to grasp certain *unarticulated* aspects of a home, through a combination of film clips, where the viewer meets people in the middle of their moving processes, combined with a presentation of items that had been left behind by the people moving.

Consequently, the *unarticulated* emerged in form of a gap between the actual stories told and the collection of left-overs presented. Furthermore, to reinforce the actual stories embedded in the film clips, we also produced a series of small booklets with pictures and quotations from the video material. With this material as a starting point we arranged two collaborative design workshops focusing one the gathering of additional experiences and reflections of the process of moving.

Throughout the collection of *Moving Stories* our preliminary ideas were strengthened as well as problematized. We found that the home environment represents aspects of both memory and visions, that it can be understood as conserving or stabilizing as well as a space for experiment and change. It represents an intersection between the need for privacy and identity formation on the one hand, and the need for an individualized yet highly communicative — and mobile — stage setting. Throughout a collaborative process that consisted in filming, collecting items and stories, editing, representing, re-representing and installing, we managed to condensate a number of rubrics out of the material, to be utilized as trajectories in a further design process.

SUMMARY

When opening up the task of designing to be more collaborative, embracing also the stage of concept or vision formation, it is necessary to find ways of collaborating across various competencies, interests and experiences. We do this by providing *intermediary spaces* to be furnished, using artistic techniques, and creating props for collaborative inquiry and design [2, 4, 6]. These approaches have earlier been successfully used in projects developing products for various work contexts [1, 2, 3, 4, 5].

Building upon these experiences we have tried to adapt our ways of working to fit into the designing for home environments. Within the over-arching research theme of *Future Living* we have earlier been struggling trying to abandon the diagnostic and problem-solving approach of industrial design. The home, more than perhaps any other kind of space, is a space that can vary but never be *wrong*; a *potential* space rather than a problematic one. We have found that paying more attention to the ethnographically inspired gathering of experiences is a fruitful way of avoiding the narrowing down of a strictly functional approach. However this might appear to slow down the design process in terms of tangible results, our research has shown that home environments — as *lifeworlds* — cannot be described in terms of needs and functions only, and thus *do not present any obvious design tasks* to be carried through. The design tasks emerge in a dialogue with the environment. Consequently, the home as an open space of bodily experience and self-reflection calls for intermediary objects of augmented meaning rather than functional objects of appropriate utility. With these experiences in mind we have found it necessary to put an even stronger focus on developing new and interrogative ways of working within the *Future Living* research theme. An outcome of the project was the heightened awareness of the central importance of an interdisciplinary approach in the development of quality-oriented strategies in user-centered design. The project was based upon the collaboration between engineers, artists and an interaction designer; intertwining ethnographic and artistic methods in order to give priority to semantic rather than rational notions of private space.

ACKNOWLEDGEMENTS

We thank the people in the five households from which the material is gathered, and the students at K3, Malmö University who took part in the video recording.

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IS IT – a diorama

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ABSTRACT

The concept of *place* may be approached and theorized through the idea of placing oneself at a location, in order not only to *be* there, but to *mediate* the spatial circumstances and the self-place interaction as such. This paper reviews findings on the thematic of place-construction and self-placing as results of a mediating act performed in art context. As a generative part of a practice-based research project, an installation was realized at an art gallery, which influenced the writing of a dissertation on the thematic of place and self-placing.

Keywords

Art, research, place, self.

PRECONDITIONS AND CONTEXT OF RESEARCH

As part of a phd-project about place and self-placing, an installation work called “IS IT,” was developed and presented in an art gallery location. The spatial presentation was followed by a version of “IS IT” as a word-image combinative and published as an article in a special issue of a cultural magazine. The exhibited work influenced the phd-project in several ways:

· It produced ideas that helped forming the thematic structuring of the dissertation. Ideas were developed in the process of realizing the exhibition, invoking concepts that would not otherwise have been investigated in the dissertation work.

· It generated a diagrammatic approach as a methodology used in the dissertation.

· The presentation of the work in art context had the residual effect of questioning certain expectations on artistic as well as scientific documentation. The artistic presentation became more explicitly referential. The dissertation work became more liberated in its relation to established methodology and argumentation

· The process of realization of the exhibition became an activating, cross-cultural, and contemplative phase in an otherwise rather monotonous daily practice of writing.

The overall phd-project may here briefly be described as an analysis, and a critique, of concepts of place as they appear in architecture theory, anthropology and art discourse. More specifically, the thesis analyses different place-concepts in their mutual tendency to exclude certain places as being “placeless.” It is thus an investigation of non-places, in the sense locations that do not have the qualities required to be “a good place,” “an authentic place,” “a socially sufficient place,” etc.[1]

“IS IT” – A SITE DESCRIPTION

“IS IT” was constructed spatially as a diorama, i.e. as a scenic representation in which sculptural and lifelike details are displayed so as to blend with a realistic pictorial background. The circumstances needed for this was provided in a gallery consisting of four rooms: three in a row that established the scenic construction, and one on the side displaying additional information.

On one of the walls in the “side-room” there is a small color photograph from 1967 of myself as a boy stretching out on a sand beach, grasping for a bottle of Cola. On a circular white

[1] As an undertaking parallel to an ongoing research program at the School of Architecture, Lund University; I participated in a one year pilot program at Valand School of Art at the University of Gothenburg. It was during this year, in this experimental research milieu based on art practice, that “IS IT” was conceived of, successively discussed, and eventually published. “IS IT” was first presented at Galleri 21 in Malmö, Sweden, in February 2000, and shortly after that as an image-text combinative in a special issue, called ‘Art and Research,’ of *Glänta*, 4, 2000. The dissertation in question is forthcoming (to be defended and published at Lund University in 2003).

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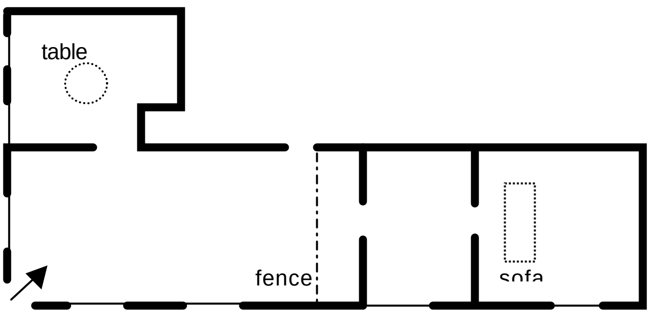
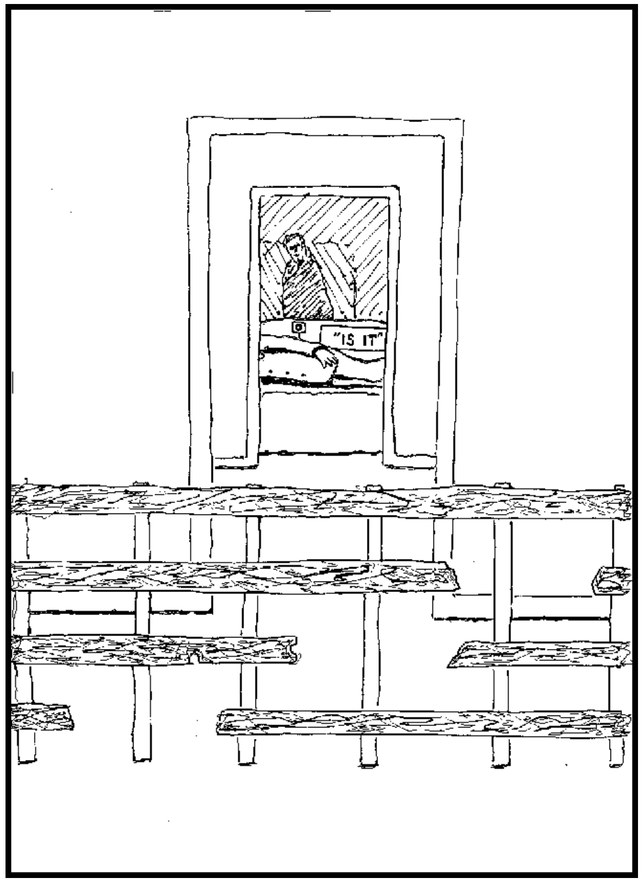
table a text is provided, telling about the occasion when the photograph was taken. It is possible to sit by the table on white, smoothly shaped chairs with seats covered by blue nylon, designed by an unknown carpenter in the 1960s.

In the big room (which you first enter) there is a hose running along one of the walls up to a funnel attached to the wall. Water is pouring constantly from the hose, then caught in the funnel and led through another hose out of the room through a side door opening. The murmuring sound of the water is taken up by a microphone attached to the funnel, then amplified and transported to speakers in the side-room. In front of the door leading to the two inner rooms there is a fence; old wooden boards are placed horizontally and nailed to fresh ones standing vertically.



Over the fence one sees across an empty room lit by bluish daylight into a last inner room characterized by a yellowish, slightly weaker, light-condition.



In this inner room a person, in the initial case myself, is lying on a sofa-like piece of furniture, essentially a bed with a leaning back support and a front slanting down to the floor. The lying person's body and the piece of furniture are both uniformed in the same beige cloth. The larger part of the body is visible, but the head and feet are out of sight, since the range of vision is limited by the sides of the doorway. Right by the back of the sofa a small video camera is positioned, directed back through the rooms towards the visitors facing the fence in the large room. The video image is projected onto the wall at the far end of the inner room, and the visitor therefore sees herself mirrored on this wall behind the lying person. Beside the camera at the furniture stands a sign-post with two words in quotation marks: "IS IT."

Preliminary Sources

The work came about as a reflection on mainly four sources: the personal memory of the photograph taken at the beach in 1967; a reflection on *Etant Donnés*,the work that Marcel Duchamp constructed during the last 20 years of his life; the modalities of artists' partaking in their artworks; a reading of the philosophical history of the concept of place.

Bagging the Beach

The first source is the principle of place-appropriation. I recall a family holiday when I was about 11 years old. Lying at a beach I suddenly felt a strong drive to create a desert landscape with myself in it posing for a photograph. This was not easy because the beach was full of bathers, kiosks, trees, toys and occasional leftovers, and the social networks and grammars reigning there were felt as prohibiting my project. I finally had to arrange a "free" spot by moving some things away and ask two persons to step aside for a while, and so the photographic act could be completed. This event, this creation of a temporary place, in order to fit it into a conception of an image, exemplifies the principle of reciprocity in the relationship between a fictional space and a real place.

Places and Placebos

The second source is derived from an analysis of Marcel Duchamp's last work, *Etant Donnés* from 1968. The work can be seen, in a first interpretation, as a return to an artistic paradigm dominated by constructions of perspective and the effects of visual perception. This seemed odd to me though, since Duchamp is generally regarded as the one who "liberated" the art object from its dependence on a material and perceptual image-plane, altering it to be a matter of the conception of the spectator and the conventions of the art institution.[2] In *Etant Donnés* it is as if Duchamp has returned to *place*, as a physical locus established by tradition, after having operated in *placebo*, i.e. in a mentally conditioned space where an image works conceptually but nevertheless reaches an actual sensed effect. However, since the set-up of this work involves a peeping viewer's position, it becomes clear that Duchamp again operates with a notion of the spectator as involved in the creation. His turning back is thus illusory. The concept of placebo serves here then, in partial accordance with the beach photography act, to illustrate the change of a traditional circumstance by way of a temporary illusion.

Self-participation: a reflection

When the artist takes place in her own work – which is quite common in art generally today, not only in the traditional performing arts – then new types of identity is produced. I am not here referring to the genre of traditional self-portrait but more generally to the aesthetic conveying of a circumstance outside of, but nevertheless by a pictorial or actional use of one-self. A couple of examples here, just to cover a large time span, could be Velazquez' *Las Meninas*, 1656, and Cindy Sherman's *Film Stills*, from late 1970s. Here, an operating artistic subject directs other instances, or roles, of the artist's self. This implies a complex unfolding of different types of selves, such as for instance an organizing self, a demonstrating self, a partially hiding self, and an emotive participatory self, all of which are present in one and the same artistic act. This production of selves could go on as a multi-generative self-reflection, especially if the artist's expectation of the audience, and the audience's expectations of the artist, is considered. A self-participatory artistic act is therefore by necessity a poly-semiotic matter.

A matter of place.

In 20th century phenomenology of place, much focus has been laid on the complex of appropriation, i.e. what it means to take place, to appreciate place, to belong in a place, etc. Quite often, and especially in architectural theory based on phenomenology, the concept of place is regarded as linked to genuine and traditional values, while a site, as the locus of a possible place is associated with exploitation, calculation or mapping. Sometimes it leads to a view that *place* and *site* are incommensurable instead of inter-relational.[3]

END REMARKS

Four thematic sources have here briefly been presented, distinguishable as having influenced not only a gallery installation and a publication made in art context, but also an ongoing research project on place and self-placing, that run parallel to these events. As an outcome of the work realized in art context, arguments were made in a dissertation work the theme of which is conceptual fabrication of place. *Place*, in the sense lived and produced space, is here viewed as a concurrence, and a merging of fictional and actual places, not as separated categories. The main thematic areas, concerning the concept of place, that emerged through this process were: the interaction between place taken and place at hand; modalities of place-self-production; "placebo" as an aesthetic function in the on-going change of places. Provisional places are thus viewed, in opposition to how they are often regarded in traditional aesthetic evaluation of for instance architecture, as productive intermissions. As such they are places to be in.

ACKNOWLEDGMENTS

I would like to thank those who participated in the discussions in the art research milieu that surrounded the realization and evaluation of "IS IT." They are above all

[2] In *Etant Donnés* an apparent violent act has taken place: a naked female torso (although with androgynous traits and partial bodily deformation) is placed, or rather left in a twiggy landscape with an artificial waterfall in the far end. One arm is holding a gas lamp pointing upwards. This scene is viewed through a large hole in a brick wall from a peeping hole in a thick wooden door a short distance away from the bricks. The work was not presented until after Duchamps death in 1968. The paraphernalia of *Etant Donnés* seems to return in other art works, for instance in Robert Gobers installation with a literally transfixed madonna and a waterfall at MOCA Los Angeles in 1997.

[3] See e.g. Edward Casey's *Fate of Place*, 1997.

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Vala's Runecast – Art/Design/Hypermovie

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ABSTRACT

Electronically supported interactive narrativity is so young and relatively unexplored, that experimental work like the *Vala's Runecast* hypermovie, produced under Studio research conditions (without insistent commercial pressure), is necessary to help build a bridge between traditional linear movie origination and production, and hypermovie/other interactive narrative in the digital en-vironment. This paper summarises how practice-based research identifies and formulates the functions of art, aesthetics and design in the processes of content-creation, production and delivery, as well as in the participative, creative enjoyment of digital interactive hypermovie. The example of *Vala's Runecast* suggests that both the production and the experience of interactors (users) con-stitute parts of a participatory design process for collab-orative dramatic narrativity; and that in content-led research the highest aesthetic standards must be observed in proof of concept prototyping for the results to be viable.

Keywords

Oral tradition, hypermovie production, digital media, interactive narrative drama, collaborative narrativity.

Art and Design in Linear and Non-Linear Movie Production – Form & Content

The *Vala's Runecast* hypermovie project formulates and tests sustainable non-linear interactive narrativity, using leading edge digital video and sound techniques, designed for Digital Versatile Disk (DVD) or CDROM publication. *Vala's Runecast* moves in a different direction from the 3D animated computer adventure-games which at the opening of the 21st century were almost the only mainstream entertainment genre to exploit the possibilities of interactive digital arts and narrativity. These generally offer single-hero epic, adrenaline-driven 'shooters' or quest-based puzzle-games, rarely played more than once. Even the most story-like (such as Lucas Arts' *Grim Fandango*, Playstation's *Final Fantasy IX*, *Resident Evil*, and *Metal Gear Solid*, LionHead's *Black & White* or the online *Baldur's Gate*) scarcely begin to satisfy the need for character-driven drama that affects you emotionally which theatre, cinema and TV traditionally supply. Dramatic characters are a powerful force for involving people di-rectly in a rich fictive or imaginative experience, and sus-taining their engagement over time. Unlike the imag-inative immersive experience of theatre or film, much interactive screen entertainment emphasises control as the participative mode of the interactor – pressing buttons or clicking the mouse determine the actions of something or someone within the storyworld. Playing on imagination rather than pure adrenaline, *Vala's Runecast* demonstrates alternative ways to involve interactors in a participative and collaborative storymaking process. It also seeks to minimise repetition with its corollary of boredom and loss of engagement. In control-based adventure games in the standard quest-format, if you click or press, the same thing happens - if you fail the first time, you can try again, and repeat a segment of the adventure. Modestly 'intelligent agents' have been introduced into gameworlds to try to counteract predictability; but *Vala's Runecast* seeks to identify and formulate other kinds of collaborative narrative practice and ways of generating engaging and satisfying interactive drama for the computer age. It develops and transforms cinematic and theatrical approaches to offer more poetic and artistic complexity than animated agent behaviour can at present achieve.

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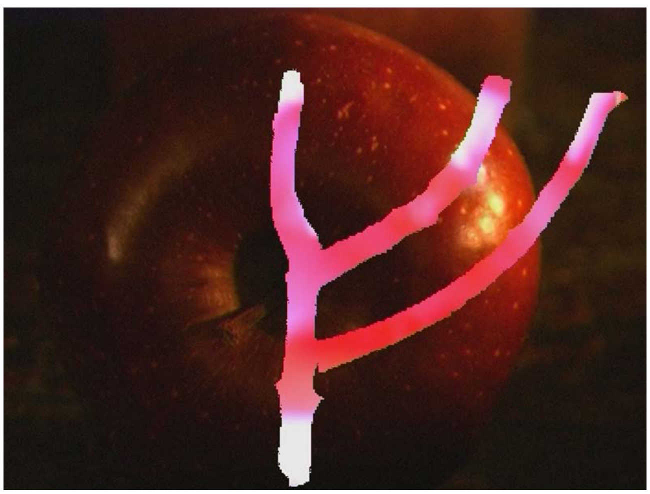
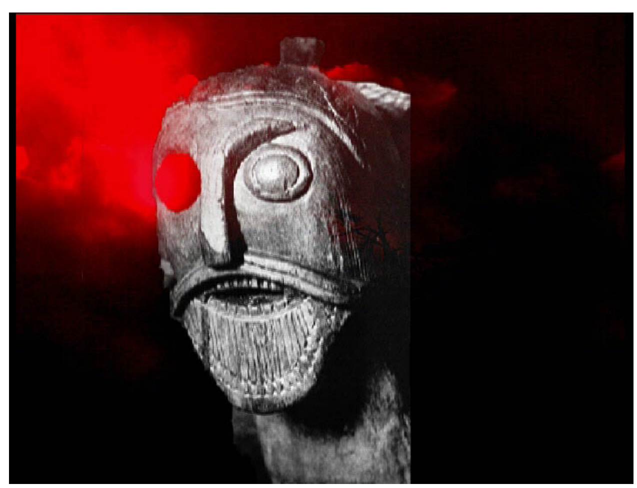
One of the great pleasures of expressive dramatic art is surely the interaction between the drama and the audience. People lose themselves in the fiction, and at the same time find a deeper self, and a unique experience, abandoning their everyday personas to identify with dramatic characters and situations, and exploring imaginatively many different roles and emotions in the course of the play, film, opera or ballet. In cinema and television - the traditional moving-image media of the 20th century - the performance and the audience's reactions are mediated by the language, conventions and aesthetics of the screen. If the artistic quality of the performance and/or audiovisual production are not sufficiently high, it will fail to engage or affect its audience. Interactive entertainment and in-formation are normally mediated by the computer, but high aesthetic quality remains crucial to providing an im-aginatively and aesthetically satisfying experience. The experimental

STILLS FROM *VALA'S RUNECAST*





research production *Vala's Runecast* identi-fies and demonstrates the potential of deep narrative structures for hypermovie, and to realise them creates an appropriate expressive rhetoric of moving images and sound for the interactive environment, which can be adopted for purposes beyond *Vala's Runecast*. All the members of the research team are professional artists and designers, exploring and developing the medium from specialist perspectives. Although the version shown at the PDC Art/Work expo is only a proof-of-concept prototype, it could not have proved the artistic concept without attain-ing high dramatic and aesthetic standards, since without these the audience will not fully engage with the content.

Vala's visitors cannot make her do things by clicking - they can work with her, exploring to find a unique personal experience under her guidance. She will not engage with you unless you actively ask her to. The research asks: can such participatory movie experience be a dramatically satisfying process? What potential has it for further development? In order to answer these questions, Vala has to be a genuinely dramatic character, whose performance engages her visitors. Both the actor and singer who perform Vala are therefore professionals, like the production team - though the role of producer, in line with the policy of the Interactive Institute, was taken by the senior researcher as project manager, in addition to her professional creative role as writer/director.

Content as Interaction Design Metaphor

The poem, *Voluspaa* (*Song of the Seeress)*, on which *Vala's Runecast* is based, is the main storehouse of modern knowledge of the ancient Nordic Gods, and has inspired artists from William Morris and Richard Wagner through WH Auden to JRR Tolkien whose *Lord of the Rings* books (1937 – 1954) have been the genesis of many fantasy-fiction and role-playing games, as well as of Jackson's blockbusting movie, *The Fellowship of the Ring* (2001). This continual renewal of the myth-material in popular culture demonstrates its enduring value; *Vala's Runecast* brings it into the interactive arena, incorporating aspects of contemplative and poetic wisdom often omitted from action-adventure versions. In the manuscript, the poem is spoken, or sung, by 'Vala', a spirit-medium and keeper of knowledge. Vala evokes Nine Worlds, where gods, men, trolls, elves, giants, dwarves and other mythical beings dwell, situated at the roots of the great Ashtree, *Yggdrasill*, whose branches support the heavens. At the tree's foot, by the *Wellspring of Wyrd*, the Three Norns - *Was*, *Is* and *Shall-be* - carve on twigs, in runes (the writing of the pre-Christian North), the lifetales of humankind, to fall as they will. The Worlds at the roots of the Ash can be seen as 'parallel universes' accessible to the Norns, and through them, Vala, while Yggdrasill itself exists in a mythic space reachable only through poetry, music, song, dance, colour, form, or trance - through Art, or through Magic. *Vala's Runecast* invokes the magic of interactive digital technology. Through her guides, the three Norns, Vala the Seeress can contact all the heroes, gods and otherworld beings of the Viking cosmos. In Nordic legend, the topography of the Mythological Realms is not linear in time or space, and the spatial and temporal organisation of the original poem, with its oral, pre-textual structure, provides a compelling model for non-linear interactive narrative in the digital environment. Content and form are inextricably interwoven. At the beginning of the 21st century, the hypermovie format has scarcely been explored, and as well as demonstrating a new structure, part of the research agenda for the *Vala's Runecast* experimental production was to help establish best practice in non-linear interactive digital movie production.

Traditional Linear Movie and Interactive Hypermovie

SLIDE 1: Linear Move Production Process:

Creating a linear movie (for cinema or television) traditionally involves ten well-documented stages:

1. Writing a concept and story outline (Art: Writer)
2. Attracting finance and production support for the project (Producer)
3. Writing a treatment of the story (i.e. a description of the way the story will be translated to the audience – through what action, in what arrangement of scenes, in what cinematic genre and style) (Art/Design: Writer, perhaps with input from Director/Producer)
4. Developing and writing a script which includes both action and dialogue, and taking it through as many drafts as necessary to achieve the required effect in the required number of minutes (Art/Design: Writer/Producer/Director)
5. Storyboarding and writing a shooting script which depict and describe exactly how the movie will be shot in order to translate the intentions of the script to the screen (Art/Design: Director/Cinematographer/Production Designer (storyboard artist)
6. Shooting the movie, when the Director translates the storyboard and script to the actors and crew, who interpret it using their individual professional skills and talents (Art: Director/Cinematographer (DoP)/Actors; Craft: Sound Recordist)
7. Post-production, where the sound and picture editors assemble the shot footage and recorded soundtrack, putting them together to make an engaging, properly paced and dramatic movie. At this stage, the 'first cut' would normally follow the script - but if sequences don't work as hoped, or if the performance of the actors cannot hold the drama as intended, movie can be rethought and edited in new ways to improve its impact. It is here that the composer normally starts to contribute. (Art: Editor/Sound Designer/Composer; Design: Director/Editor/Sound

Designer/Producer)

8.Marketing (Producer/Sales Agents)

9.Distribution (Producer/Sales Agents)

10. Exhibition (Cinema/BroadcastNetworks/Video/DVD)

Team:

Producer; Director (artist/designer); Writer (artist); Production Designer (artist /designer); Cinematographer (artist); Sound Recordist (craftsperson); Editor (picture) (designer/artist); Sound Designer (designer/artist); Composer (artist)

Since 1980, the entrance of digital media and the computer into the movie-making world has had significant effects on every stage of the production-process. By 1998, the fully digital movie was born, and by 2002 electronic distribution and delivery for big and small screens, including inter-active media, were a fact. *Vala's Runecast* identified a number of major differences between the traditional movie production process and the interactive digital process, especially in the new relationship between the art, design and craft components. These shifts are radical, including the introduction of interaction and interface designers, and a graphic designer, at an early stage in the process. *Vala's Runecast* also required a Visual Director/Animator with painterly as well as cinematographic and editing talent and skills, who was responsible for the final look of the production (including graphics and effects) - a different role from that of the traditional Director or Designer, and demanding a different skillset. While the Director deals with live-action shooting (directing both performers and crew) as well as overseeing the production-design, photographic, editing and sound-and-music teams, and was responsible for the overall style of the movie, the Visual Director and Editor needed excellent technical knowledge of the capabilities of digital media and standards used both in the production process and for delivery, as well as original creative talent and a full understanding of narrativity and story structure. As in all computer-based art, visual design carried a great deal of weight from an early stage, and the whole team began to collaborate closely, sharing skills and knowledge, much earlier on than on a traditional cinema or TV production. This artistically ambitious production was made by a small team of people working collaboratively from the outset, using modest (upper low-end) equipment, an approach set to spread in the 21st century. With the use of the computer both as tool and as medium, the balance between art and design within the whole sequence, from concept to delivery, altered significantly.

SLLIDE 2: Hypermovie Team Breakdown

Vala's Runecast production team role breakdown:

- Writer/Director (experience in screenwriting, music theatre writing, choreography and directing, stage and radio writing and directing) (Originated concept, wrote performance script, directed performance and overall work; also acted as producer)
- Visual Director (experience in painting, photography, animation, writing and directing for film, writing for radio, video art work) (Shot footage, manipulated images, created animations, edited sequences, interpreting script with full artistic license in close collaboration with writer/director)
- Editor/Graphic Designer/Interaction & Interface Designer (education, training and experience in film and video editing using both traditional and digital systems; shooting, and sound recording/ editing using digital media, theory and practice of interactive digital moviemaking) (edited material for interactive treatment; shot additional material where necessary; mixed sound for interactive treatment; designed screen graphics and combined digitally-captured images with computer graphics images; designed graphics for print and poster material; programmed using 'Director' where appropriate)
- Composer/Sound Designer (education, training and experience in composing for traditional and electronic instruments and media; use of algorithmic composition media; interactive games music composition) (Composed instrumental music; composed, performed and recorded songs; recorded spoken voice performance; designed sound effects and environment; mixed sound)
- 2 cinematographers in addition to the Visual Director (experience in photography, feature- TV- and art- movie making) (captured images of landscape, shot studio footage under direction of Writer/Director)
- Consultant Interactive Dramaturg, Interaction & Interface Designer (experience in theatrical performance theory and practice; Web interactive navigable sound-and-image story; avatar worlds) (worked with Writer/Director on the material to create appropriate navigation and interface)
- Interactive Programmer (and additional interactive programmer) (experience in programming using a number of languages but not, till this, Director) (programmed the interactive experience as designed by the Writer/Director with input from consultant Interactive Dramaturg /Interface Designer/ Interaction Designer, as well as Editor

Team (excluding performers)
Writer/Director/Producer (artist/designer) Maureen Thomas
Visual Director (artist/designer) Brian Ashbee
Cinematographers (artists) Ashbee, Gudmundsson, Wright
Editor/Post-Production Designer (designer/artist) Ludvig Lohse
Composer/Sound Designer (artist/designer) Karina Gretere

Consultant Interactive Dramaturg/Interaction Designer (artist/designer) Mika Tuomola
Consultant Interface Designer/Interaction Programmer(designer/artist) Gunther Heinrich
Programmers (designers) Anders Vedmar, R. Manton

SLIDE 3: Non-Linear Digital Interative Hypermovie Production:

Ten stages of *non-linear digital interactive movie* production:

1. Writing a concept and story outline (Art/Design: Writer/Director)
2. Attracting Finance (may involve arts funding, multimedia-production/publishing companies including those dealing with print, CDROM (music and moving image), DVD, entertainment, games, education, information; as well as movie/TV/Digital Broadcasting/ Netcasting organisations and mobile communications companies) (Producer)
3. Developing, writing and refining a script which includes both performance and structure (Art/Design: Writer, who has to be familiar with the potentials and limitations of interactivity and digitality, and may therefore need to work in consultation with the Interaction Designer/Producer)
4. Writing and Storyboarding a treatment of the story (Art/Design: Writer/ Director / Editor / Interaction Designer / Interface Designer / Graphic Designer / Producer)
5. (Storyboard and shooting script - this traditional stage *can conveniently be smoothly amalgamated with Stage 2 of the digital production process)*
6. Image and sound capture - including live action, photorealistic, graphics and computer-generated imag-ery; sound effects and music; (Art: Director / Cinematographer (DoP) / Actors; Sound Recordist / Designer)
7. Post-production - The Sound Designer and Picture Editor work using the same or closely related electronic equipment, and on a small production, may well be the same person, assembling the shot footage and recorded soundtrack to make an engaging, properly paced and dramatic movie. The Editor works with the Program-mer to ensure that the media assets are appropriately cut and where necessary looped and/or layered, correctly labelled and located for retrieval via the computer program (Director) (Art/Design: Editor (Digital Effects) / Graphic Designer/ Animator (Digital Effects) / Sound Designer / Composer / Interaction Designer / Interface Designer / Director / Producer)
8. Marketing (Producer/Sales Agents)
9. Distribution (Producer/Sales Agents) (May involve multimedia-publishing companies dealing with print, CDROM (music and moving image), DVD, enter-tainment, games, education, information; as well as movie / TV / digital broadcasting / netcasting organ-isations and mobile communications companies)
10. Exhibition (Artspace/Cinemas/Broadcast Networks/Web/Mobile Device/ CDROM/DVD)

Team (excluding performers)
Producer; Writer/Director (artist/designer); Visual Director (artist/designer); Editor/Post-Production Designer (designer/artist); Composer/Sound Designer (artist/designer)
Interaction/Interface Designer (designer); Programmer (designer)

Production as Design Process

Vala's Runecast practice-based research revealed that for digital interactive hypermovie production, the traditional moviemaking team was best reduced from c.9 to 5, and then increased to 7 as an interaction designer and pro-grammer were added. At 6 out of 7 stages of the creative process, Art became inextricably intertwined with Design, while the talents and skills of each member of the team combine with those of each of the others throughout. The role of these team-members in the production tended to reduce the supremacy of the movie Director, redistributing responsibility and authority between the writer, editor, graphic designer, sound designer and interaction/interface designers, who all participate actively in the creative shaping of the final product. In short, the integration of digital sound- and image-capture, manipulation, and editing, with the computer as tool and medium, makes the interactive hypermovie production into a collaborative de-sign process rather than one dominated by a single director or author. Movie production has always been a team activity, but a linear process where the director is supreme. Algorithmic editing of the kind used in the *Vala's Rune-cast* experiment also brings the hypermovie closer to participatory design than to more traditional art-forms like cinema, in that it composes layers of pre-formed audio and visual elements (contributed by the team of artists author-ing the work) into complex sequences determined by the interactor (user/client), mediated by the program, and not solely by the director. Without the interactor's participation, there would be no narrative.

Collaborative Narrativity – Associative, Episodic, Improvised, Ephemeral

In effect, in interactive hypermovie, the interactor functions as a member of the design team. Visiting Vala (or interacting with any other hypermovie instantiating the underlying system created for *Vala's Runecast*) requires interactors to make choices, to determine the way the spatially organised narrative content can be explored and finally expressed. The choice-points are designed, as far as possible, not to disturb the visitors' immersion in the fictive experience. The Viking-age practice of casting the runes, which is intrinsic to the content, makes explicit the relationship between Chance and Destiny underlying the algorithmic structure, and provides a simple interaction metaphor, a recognisable situational relationship (fortune-teller/seeker) between the work and the interactor. It also inspires the system's mathematical use of sensitive dependence on initial conditions, which enables individual visitors to generate many new versions of the experience which all make associative narrative sense, though they cannot all have been foreseen by the authors of the content. Only digitality makes possible this open-ended framework. The interactor can choose the first condition (select a specific rune) which initiates the computer's random choice of five expressive narrative video landscapes (opened by 5 characterised runes). The six narrative layered sequences associated with the six runes of a single Runecast are all the visitor can explore in one session, and the whole narrative experience depends upon the interactor's setting of the initial conditions. When interactors enter any one of the runescapes, they can explore the content in an order they choose, or wander randomly. They cannot, however, repeat any part of the experience, because, in each session, the system (personified by Vala) removes material from the narrative landscape (database) once it has been activated.

The logic of the narrative content itself is associative rather than causal, a poetic structure used in linear movies from *Citizen Kane* (Welles 1941), *La Jetee* (Marker 1962), *The Phantom of Liberty (*Buñuel 1974), *Mirror* (Tarkovsky 1974), *Koyanisqatsi* (Reggio 1983), *Drowning by Numbers* (Greenaway 1988), *Orlando* (Potter 1992), *Short Cuts* (Altman 1993), *12 Monkeys* (Gilliam 1995) and *Mrs Dalloway* (Gorris 1997) to *Timecode* (Figgis, 2000) or *Mulholland Drive* (Lynch 2001), as it was in Viking-age oral poetry. The material in all Vala's runescapes is connected partly thematically (through Nordic Mythology and the relationships between its characters); partly formally (each runescape contains verses, tales and songs with matching metrical and stylistic characteristics); partly through relationship to a central situation and image (the 3 Norns at the Well beneath the World Ash, carving and casting the rune-twigs); partly through relationships to a central story (the myth of Baldur, Frigg and Loki); partly through aesthetic properties (music, visual style, voice-over) – and, to a great extent through the character of the storyteller, mediator, guide and presenter, Vala, and the way she activates each individual interactor's memories, dreams and imagination. The structure of *Vala's Runecast* is episodic, each individual runescape containing material focused round a particular hero, and this gives it great temporal flexibility - shared not only with Eddaic poetry, but also with many mediaeval compilations deriving from oral tradition, such as the stories of King Arthur and his knights, or Robin Hood and his merry men; a format which manifests on contemporary TV in relatively non time-specific space operas like *StarTrek*, *Stargate SG1*, or *Andromeda*, sitcoms such as *Friends*, and series like *Smallville* or *Xena*. However, in *Vala's Runecast*, the interactor is a necessary part of the process of composing the narrative. Vala speaks (though in trance) directly to interactors, telling their personal - unrepeatable - fortunes, as well as offering stories and poems from her repertoire. This makes the dramatic narrative process a collaborative one, between visitor, performer and authors, mediated by the computer hardware and software. The interactor is not the artist, but functions as a member of the design-team, creating the final experience, working with the digitally-captured performer so that she can (with the help of the computer) improvise with her material - as jazz performers and improve actors as well as oral storytellers do. Only 6 runes of 22 can be accessed in any one visit, so stories, knowledge and understanding are built cumulatively over time by each individual interactor, as in oral cultures. Vala does not repeat lines according to a fully pre-determined script, at the prompting of a mouse-click. With the help of algorithmic editing, she gives a fresh performance for each visitor, as part of a collaborative process between visitor, system, artists/designers and digital performer.

Conclusions

The *Vala's Runecast* experimental hypermovie production shows that the whole process of computer-supported interactive digital production can become a satisfying creative collaboration between artists and designers; and that, through the use of the computer both as production tool and artistic medium, people who in the context of traditional linear movies are 'consumers', become active members of the design-team, composing the final dramatic experience in a process of collaborative narrativity. In order to determine whether this role produces genuine narrative satisfaction and aesthetic pleasures of its own, the prototype has to reach levels of artistic and aesthetic as well as technical, creative and skills-based achievement sufficiently high for the experience to compare with traditional screen entertainment and contemporary interactive art-installations and adventure-games. To test and formulate how interactors can move from the participatory enjoyment of storytelling with artists and designers to creating their own stories collaboratively through avatar-based role-playing, a Real-Time 3D Virtual Environment (RT3DVE) version of 'Vala's World' is planned, for which the *Vala's Runecast* hypermovie provides a necessary first step. Without knowledge of a cast of characters, and familiarity with story-models and expressive conventions, no-one, whether expert artist/designer or talented amateur, can generate effective narrative dramatic art. *Vala's Runecast* exemplifies one structural matrix for spatially organised narrative, which can enable new stories as well as new collaborative communicative and creative learning situations to emerge, as open-ended frameworks.

SPACE BLANKET

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ABSTRACT

Space Blanket is a malleable fabric-like fragment. This element is often referred to as a '<u>geometric protoplasm</u>': a simple grid system with a slippage mechanism, offering fluid properties.

I have delved abstractly into the realm of surfaces and structures whilst discovering the individual's desire to mould one's own space.

This work challenges conventional ideas about *constructed space* versus *dynamic space*. The intention is to question psychological experiences and memories of personal space.

Have we failed? Have we truly entered the technological millennium? New vistas have been forged yet, have we fully embraced or even shared our new-found technology? Would we dare to challenge our discoveries, our triumphs?

Can we honestly state that we have accomplished a deeper, richer sense of life? What has prevented this merging of insight? Would we base our arguments on inertia - ignorance?

We have witnessed an explosion of knowledge. Yet, I often wonder and search for human insight. Are we being sensitive to the human condition? Or have we de-sensitise, de-digitalise ourselves from the physical and spatial environments?

Are there alternatives or risks between contemporary technology and cultural impoverishment? Today, communications between the disciplines seem necessary to preserve the vision and maintain the human [humane] experience - the idea and the feeling.

To me, interactivity is both a collaborative process + product.

The root of this work and exploration is based on creative inspiration. I looked to the moment when the scientist, architect, engineer develops a seemingly simple idea further. The inventions of Frei Otto and Buckminster Fuller particularly demonstrate a historical instance when an idea becomes a manufactured norm – the assembly of the unit.

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The project began in a workshop then moved to a *'collaborative research laboratory'*. Essentially reversing contemporary processes. Present-day discourse tends looks to the computer screen + digital outputs when speaking about concepts of fluid space. Today we are experiencing an influx of the intangible digital environment phenomena [Greg Lynn, Hani Rashid]

Particular to my interests, initial explorations led to a search for surface and structure. Also, I began investigating the close links between art and science. At the point of interest where, the hybridisation of science and art become closer to design.

In John D. Barrow's book *<u>The Artful Universe</u>* he speaks about how science and art are two things uniquely human. To quote from his book: " *They witness to a desire to see beyond the seen. They display crowning successes of the objective and subjective views of the world. But while they spring from a shared source – the careful observation of things – they evoke different theories about world: what it means, what its inner connections truly are, and what we should judge as important."*

Mr. Barrow attempts to diverge science and art in a way that things are admired rather than explained. In the similar spirit I would like to present in the manner of diverging and admiring.

Initial investigations began by questioning the logic of physics - *constructed space.* The nature of building has been mandated with convention: straight walls, rigid frames, the essential laws of physics

Existing construction methods were challenged while; materials were manipulated by hand. The tactile registers the memory/experience then; the subjective personal informs and pushes the evolution and discovery hence, *<u>the surface structure response.</u>*

Traditionally surfaces speak about volume and delineate *constructed space* - the journey began by challenging the concept of surfaces. The quest for dynamic surfaces lead to an increase in questioning of conventional building materials whilst forging towards a new architecture, a new experience.

Can surfaces do more, be more? Be part of the more holistic humane experience? Can we explore the interactive tactile experience?

By addressing the physical feature of a material, we can begin the exploration.

Science + Nature

I became intrigued by contemporary theories and discoveries made in Nature and Science.

Initial interests were looking at how things in nature arrange themselves - recognising repeated patterns and designs found in nature. While the aesthetic creations and artistic metaphors were the initial draw, however, I began to further study the theory of design.

Both Kepler and Einstein have judged their theories not just on data but on the kind of order they produce. The discovery was equal to the design.

The creation of natural pattern and design has become an exploration from genetics to computer stimulations. Interestingly, this is a movement away from the traditional route of studying the abstract theories of physics and mathematics.

Today contemporary sciences rely on the use of the concepts of design and pattern in computer simulation and calculation. Complex and geometric structures are constantly being explored.

As for myself, I began delving into structural formations found in nature. Carefully examining nature's microscopic structures. In particular, the intricate latticework of Venus's flower basket sponge, a grain of salt to complex systems formed in various spider webs. This interest and research has led me to discover and study work related to geometric structures.

Here are the following examples of current interest:

Dr. Penrose, an Oxford University physicist researching 'tiling'. Dr. Penrose devised various pairs of complementary 'tiles' – parallelograms that can be laid on a flat surface with their edges joined. Essentially, covering a flat surface with no gaps between the tiles. The patterns formed have endless variations and do not repeat themselves.

A further development of Dr. Penrose's work was the discovery of recent data announced by Dr. Steinhardt and his colleagues on quasicrystals. Dr. Steinhardt notice the possibility of building a three-dimensional structure analogous to a smooth, gapless surface covered by two-dimensional Penrose tiles.

Quasicrystals are found in alloys, aluminium and transition metals. Physicists have long been interested in why atoms form complex patterns. The evidence found the atomic jigsaw puzzle, in which identical pieces are allowed to overlap each other to form complex structures. This new data is questioning the traditionally known rules of geometric relationships.

The above research is complement to the studio work. Here, I would I like to introduce the 'space blanket'. As well as, introduce some areas of architectural applications and theory.

Space Blanket is a malleable fabric-like fragment. This element is often referred to as a '<u>geometric protoplasm'</u>: a simple grid system with a slippage mechanism, offering fluid properties.

In respect to Gottfried Semper, I am influenced by the moulding capabilities of materials, and the concept of a *petrified fabric* found in bricks and tiles. The work thus far, has been involved in material metamorphosis.

I now look to the *'first architects who wove their walls'*, in hopes of furthering the links between architecture and the fibre-arts.

My research looks at theoretical ideas and representational concepts in architecture and the fibre-arts. Surface, structure and motion are concepts I work with. I have been bridging both the theoretical and the practical by way of inventive technologies.

C. Stanley Smith wrote in <u>A Search for Structure</u>, speaks about the less widely known historical facts of the first discovery of useful materials, machines or processes has almost always been in the decorative arts. To quote: ' Discovery requires aesthetically motivated curiosity, not logic, for new things can acquire validity only by interaction in an environment that has yet to be.'

Finally, my attempt was to give an overview of general themes of the ***Space Blanket***.

I have delved abstractly into the realm of surfaces and structures whilst discovering the individual's desire to mould one's own space.

My research looks to valuable insights into existing and emerging practices of design and technology. Often my questions probed into the transition from what is learned from studies of work and to the social interactions experienced. The relationships between technology and the individual are customarily neglected. It is my aim to move towards human-centred design.

This work challenges conventional ideas about *constructed space* versus *dynamic space*. The intention is to question psychological experiences and memories of personal space.

My interest in kinetic fluidness allows for form to move within a multitude of purposes and context. In essence, my aim is to create malleable adaptable environments by way of incorporating technology with new material specifically addressing memory and experience.

Summation of the work: The micro-read as fragments of art. The macro-read as hybrids prototypes of functional architectural fragments.

The Faculty of Mimesis

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ABSTRACT
This paper originates from a text that was developed in close relation to one of my works of art, with the title Audience point of view. Like this work, my text is an argument for a profound change in attitude concerning mimetic representation, where neglected associations in every day life provide a resource in planning of society and its design processes. This change embraces a higher sensitivity towards small spaces and events that are going on in a minor scale. My opinion is that the architectural model by this gets a new meaning. It is no longer just a mockup, second to what might be called real architecture. It is central in several types of design processes.

Keywords
Mimesis, representation, architecture, art, model

INTRODUCTION
In one aspect, architecture is regarded as a liberating process where creativity is a central concept. Also in the architectural education this is one of the most important and powerful motives. Of course this approach is in line with a romantic-modernistic tradition, which worships the act of creativity and the abandonment of rules. Here, the ability to see, or realize, something as something else is in focus. By this we also touch upon the concept of mimesis, or mimetic representation. This approach to architecture also gives rise to a very special type of ambiguity, which could be put like this: It is all right to be inventive and see possibilities in the constellation of facts and artifacts, especially when hiding aesthetical arguments in rationalistic ones. But it is not accepted, I would say, to over do it and play with things, even if you have very serious intentions. The scaring horizon for many architects is here the risk that his or her work will be condemned as kitsch.

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Hereby, I am not arguing for banal types of architecture where, for instance, houses look like ducks or binoculars. This type of Architecture is problematic since it, as single examples in most cases risks to confirm its opposite. Houses that look like enlarged artifacts hereby play the role of comic effects, in contrasts to a dull surrounding. Rather I want to suggest the notion of a profound change in attitude, where neglected associations in every day life provide a resource in planning of society and its design processes.

THE MODEL
This change embraces a higher sensitivity towards small spaces and events that are going on in a minor scale. Here, the architectural model gets a new meaning. It is no longer a static representation of buildings and urban settings, which is a very conservative attitude to mimetic representation. The model is no longer an architectural wannabe. Instead it is a generative part of architecture itself.

It is not revolutionary, or all pervading new, to elaborate on the relation between architecture and the model in terms of representation. Already in the end of the sixties, the American architect Peter Eisenman coined the concept "*Cardboard Architecture*". At this moment, he was inspired by Noam Chomskys linguistic deep structures, in the search for an autonomous architecture. In describing his two first houses, *House I* and *House II*, Eisenman talked about a nonspecific scale that "was achieved by employing conventions of the architectural model in the actual object. The houses looked and were constructed like models. They were built of plywood, veneer and paint, and were without the traditional details like mullions, flashings and copings conventionally associated with an 'actual' house. Viewed without the external, scale-specific referent, these houses could just as easily have been models as mega-structures", writes Eisenman in his book *Houses of Cards*, from 1987 [1]. An example taken from contemporary art, that happens to illustrate Eisenmans intention with his *Cardboard Architecture* is Charles Rays *Fire truck*, from 1993, which has the character of a mega-structure model, or rather a toy in the size of a real fire truck.

Cardboard Architecture Is definitely not one of Eisenmans better known concepts, even if he elaborated the confusion concerning representation in a slightly different way in some later works. A general theme in the post structuralistic discourse, which Eisenman at least took part in, was (or is) questions regarding representation, or hierarchies. According to this, The *Cardboard Architecture* is a typical product of a post-structural era. This also means a fixation to questions about “What is represented – what represents”. Later on, questions concerning representation have taken a new turn into a diagrammatic paradigm.

THE DIAGRAMMATIC PARADIGM

It is tempting to see recent examples of avant-garde architecture, grounded on diagrammatic aspects, as the final controversy with mimetic representation. But even here, we have to face the ever-returning concept of Mimesis, although it takes many new directions.

In the history of architecture, the diagram has been an important tool in the production, as well as in the analysis, of architecture. Its status has varied through the years. Traditionally, it has been regarded as something technical, something separated from aesthetic values. In short, the diagram has other iconic qualities than the traditional drawings and models. The latter shows a more straight (and mimetic) representation of the building or the city. In most cases, the possibility to be built is inherent in a plan or in a drawing. Here, the form of the diagram is related to itself rather than to an external object.

In his article *Diagrams of Utopia*, published in the architectural magazine *Daidalos* [2], Anthony Vidler highlights when diagrams are transferred directly into architecture. The illustrated example here is the Japanese architect Kazuyo Sejima’s *Study for urban housing* from 1996. Vidler mentions a tendency, where a second, ‘formal’, current of diagramming has emerged, that distinguishes itself from the more functional aspects of diagrams in architecture. Here I would like to add that this also means a reestablishing of a mimetic relation between, what we can call, the real architecture and its representations. Beside this type of vertical relation, where an object represents another object in a mimetic way, other, more horizontal relations are emerging. In these relations models or diagrams looks like other models or diagrams. I just mention this, but will not elaborate further on this theme, since it has to do with a more general level, which actually also is a catalyst in the development of trends and fashions. Rather, what is important here is the returning of mimetic representations or look a like effects.

CONCLUSION

In my presentation of some approaches to contemporary architecture, the mimetic representation tends to be a problematic dilemma. Why, might one ask? I think one of the main reasons is the avoidance of banality. Since architecture is a very serious matter, perhaps the most important contribution to the infrastructure of society, the architect must avoid banal motives in his, or her, practice. Here, the mimetic treasures of everyday life, are in most cases condemned as something easily found, or cheap. Abstraction and reason are still the virtues of Architecture.

In other branches of art (if we consider architecture to be a branch of art) this does not seem to be problematic in the same way. In contemporary art, there is a wide spectrum of personal approaches to serious matters and political issues. Architecture is, after all, strongly limited to concepts as representation, diagram, processes and infrastructures, whilst contemporary art in one aspect, seems to be more unlimited in establishing new possibilities. It is also interesting to notice the big interest for architecture in contemporary art. Personally I see this as an opportunity to vitalize the architecture of today. To make this possible, it is of great importance that the interest is reciprocal, that architecture also takes care of the influences from art. I will underline that I am not arguing for an unreflecting approach to art as a salvation to all problems. Rather I am talking about the possibility that the multiplicity in contemporary art can influence, and subvert narrow-minded attitudes in the field of architecture.

ABOUT MY ARTWORK

My artistic contribution to the Participatory Design Conference 2002 was produced in close relation to this text. Its title is *Audience point of view*, and might best be described as a mimetic constellation of traditional office equipment. The result is a lecture hall in a small but unspecific scale, where about hundred chairs are made from paperclips. Hereby the mimesis is meant to provide a further generative principle in the fields of architecture and design.

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"Psst"-ipatory Design: Involving artists, technologists, students and children in the design of narrative toys

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ABSTRACT

The aim of the Narrative Toys project is to develop new concepts for toys/play environments that support children in reformulating stories, through a combination of physical artifacts and digital media. The focus of the project is how toys act as a storytelling medium, and in particular the exchange between stories inscribed in toys by toy manufacturers and stories invented by children during play. The project is also characterized by its aim to accomplish "creative research"- using artistic means to create and convey knowledge. This paper describes two prototypes, Psst and the AudioTheatre, and how they relate to research aims and artistic creation.

Keywords

Interactive toys, play, narrative, design

THE NARRATIVE TOYS PROJECT: BACKGROUND

Play and narrative are closely connected in children's development. Bruner [2] and Schank [7] have described the importance of stories as carriers of patterns for behaviour, ethical and social values, and in general how shared stories are fundamental to communities. Children's play is nourished by all sorts of stories. Stories are tried out in play in a improvised manner between telling and enacting. The tight connection between toys and stories is also visible in any toy store. The shelves are filled with characters from other media: Harry Potter, X-files, Star Wars and so forth. Toys today are a mass medium, a channel where stories get published in parallel to film, comics or computer games.

Where an older generation of children sought inspiration for play in genre scenarios like pirates or cops and robbers , today's kids tend to base their play on "authored" stories from films or TV shows.

This dynamic between mass media, narrative, and play is the backdrop of the Narrative Toys project. We are exploring the cross-breeding between stories inscribed in toys and stories invented by children during play. How can toys deepen the understanding of narratives by giving children the tools to unfold them both in time and in physical space? Can we design new kinds of toys and play environments in which the combination of narrative information with physical artifacts supports children in staging, enacting, retelling and modifying stories?

The two prototypes we present both explore the interplay between authored stories and stories invented by children during play.

Method

Our working method was to stage a process of collaboration in two successive steps. In the first phase the collaboration includes project partners from different backgrounds: artists, designers, engineers, toy manufacturers, students and guest researchers. The process at this point is characterized by a large degree of creative freedom given to the participants. In this first phase we do not aim to include the users, i.e. children, in the process of design. Focus is on project participants' input, and the diverse systems of thought and work that they bring into the prototyping. Our prototypes are designed to be flexible and easily updated with new media or play formats.

But we do work together with children - making interviews, drawings, or through organized play around a theme related to the design. In this respect we draw on earlier work on participatory design with children by Druin [4] and others.

Related research

The StoryMat project by Cassell and Ryokai [3] supports children's storytelling through a computer system that records stories connected to a physical interface; a mat and soft animals. The EU FET I3 KidStory project [1] has dealt

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with the development of storytelling technologies for children in a school setting using participatory design. The EU FET- I3 Pogo project [6] has similar aims to KidStory, but a decidedly design-driven approach. Earlier research at Interval resulted in the Zowie products: a combination of physical toys and cd-rom games. The physical toy represents the setting of the game (garden, pirate ship) and is also use as a tangible interface to navigation and gaming. The Zowie technology was bought by Lego and is not available on the market at present.

Figure 1. The Psstian characters: Max, Klump, Spuki, Memo, Spiri, Krax, Spak, Kilo and Mingo.

PSST! - THE PROGRAMMABLE SOUNDSCAPE TOY

With Psst [5] children can explore a set of characters: what they do, how they talk, where they are. It consists of nine dolls with ID tags and six play boxes. A sound database with talk and event sounds provide the feedback.

Children play with Psst by placing the characters on the contacts on top of the boxes. Depending on the play format running, placing a character on a contact yields different results: an utterance in the specific voice of the character, an event sound, an environmental sound describing the location. The characters are open-ended, inbetween human and animal, and they are designed to leave the question of age and gender open (with a few exceptions).

The play formats range from game-like to story-like activities. The Psst-Talk play format creates conversations between characters, the Ghost Hunt describes how a ghost is tracked down and captured in murky horror environments.

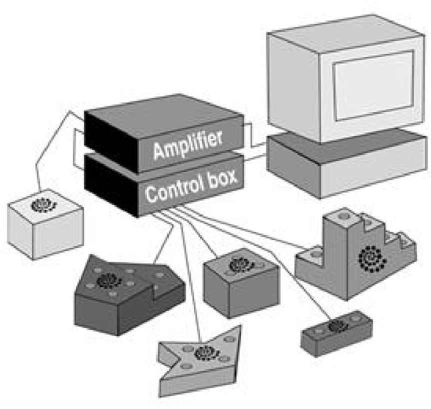

Figure 2. The Psst setup. The box to the left has no contacts. It contains the “narrator’s voice”.

The Platform

The Psst platform is designed to answer to the following requirements:

- It supports experiments with objects and sounds
- Children can play with it without much supervision or many instructions
- It is easily updated with new media, tagged objects or play formats
- It takes advantage of the physical space where it is standing
- It is robust and safe

The Creative Content of Psst

The work leading up to Psst started with a series of design sessions with children in a daycare center in Malmö. To each session we brought different materials (cardboard, colours, clay) and some low-tech prototypes in order to map out play opportunities around sound and physical artifacts.

We designed the characters through a series of rapid brainstorming workshops. The actor Niels Bender recorded utterances in nonsense language for the nine Psstian characters, according to a systematic grid where each character has a set of phrases expressing joy, fear, anger, sadness, questions etc. In defining the voice for each character Bender used aspects of the dolls as a starting point. Each voice is rich in gestural quality, and it matches the body posture suggested by the dolls.

Figure 3. Actor Niels Bender giving voice to Spak.

The sound database, which includes both event and environmental sounds, was designed by sound artist Hanna Hartman. She worked closely together with us, and the style of her sounds and her way to combine sound elements into stories had a large impact on the first generation of play formats.

Evaluation

The Psst platform has been tested in families and in child day-care centres in Malmö and Copenhagen. We have tested it with children age 4 to 6. Although children sometimes have had difficulty placing the characters on the contacts, the platform has been surprisingly resistant to heavy use. We have been able to add and modify play formats easily. The Psst platform has on the whole matched the initial requirements.

Figure 4. Children exploring PsstTalk.

With Psst, we started out with an idea of non-linear narrative, in the sense of creating a sphere of action for the user within the story. But play observations gave negative results in certain cases. What seemed to most interest the children was to understand the system. The rule-based scenarios in which the sound output is directly related to a single character and a fixed position worked better than scenarios relying on sequences of sounds.

These observations from Psst caused us to re-evaluate our initial idea of non-linear narrative in favour of simpler narrative structures.

Figure 5. Listening to the narrator's voice.

THE AUDIO THEATRE

The AudioTheatre is a continuation of the ideas in Psst!, and it uses the same basic technology. Based on the observations in Psst we wanted to reduce the complexity, and create a more coherent system to be explored in the toy. We also wanted to strengthen the "do it yourself"-side of the toy. The concept was inspired both by the Lego Studio set, which lets children record and edit films, and by classic toy theatres in paper.

Figure 6. Toy theatre. The hand plays an important role as the most animated object on stage. *(Picture from postcard)*

The AudioTheatre is a tabletop toy theatre with paper doll actors that are placed on a stage in shape of a box with twelve contacts on top and a loudspeaker inside. It has two play modes: playback mode or record mode. In playback mode a pre-recorded theatre piece is performed. A booklet gives instructions about backdrops and how to place the actors on stage. The "actors" are paper dolls cut in foam, placed on a plastic plugs with a small switch. Both paper dolls and backdrops have ID tags that can be read by the computer. When you push a small button at the footpiece of the actor, it will say its line or tell you that it is not on the right place.

Figure 7. The actor footpiece with button and ID tag

In record mode new lines can be recorded to the actors directly on stage, and played back immediately. The utterance is linked to the character and the position on stage. The two modes can be combined. The playback mode is designed to take children through a relatively complex series of manipulations, and also teaches the user how to use the record mode.

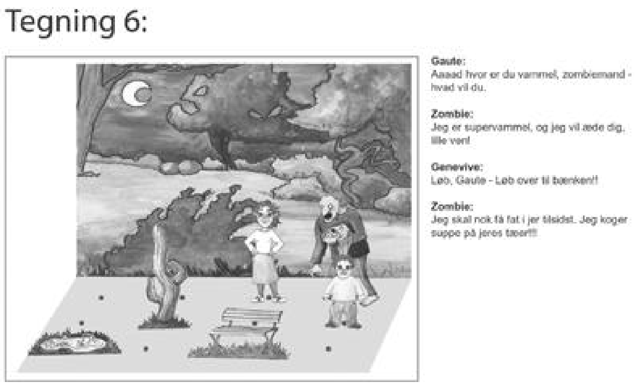

Figure 8. A booklet shows how to place the actors on stage.

The Design Process

The AudioTheatre started out with a clear concept, based on observations of the Psst platform in use. The content was then developed by playwright Martin Rauff-Nielsen and interaction designer Sanne Fraas. The theatre piece, Halloweek, is a slightly absurd story about a brother and a sister going out in the park on the Halloween evening, discovering a bunch of monsters instead of the ordinary environments. Sanne has made cartoon-like illustrations for the piece, which render environments and characters with lots of detail.

Figure 9. Playback of the pre-recorded piece Halloweek

Preliminary Evaluation

Small groups of children (one to three children, age 5 to 12) have tried out AudioTheatre. At first, we invited them to play through the prewritten piece. When they had played it through, we demonstrated how they could use the recorder actors.

All children that tested the AudioTheatre started to create stories of their own, involving a sequence of utterances and several characters. They had no problem identifying which actor was being recorded, and saying the lines for that specific actor. This had been a problem in Psst.

Figure 10. Recording new lines to home-drawn actors.

The AudioTheatre comes closer to being a “narrative toy” than our earlier prototypes, in the sense that the narrative structures provided are visibly and audibly used by the children to build new stories for the platform. However, all children had difficulties remembering the position of the character relative to each utterance. Some of them resolved this by creating a chart showing characters and positions during the play. In future prototypes we would like to go further in exploring how the timeline can be represented spatially.

CONCLUSIONS

Although Psst and the AudioTheatre are closely related in content matter and technology, they represent different ways to combine artistic creation and research.

In retrospect, Psst is to a high extent a “piece”, a creative production that carries significance on many levels. The AudioTheatre on the other hand is more useful as a prototype: it is designed to explore a specific dynamic, it is split up between concept and content - which makes the observations more easily generalisable.

In Psst, research considerations and artistic design were mixed up. This has made a prototype that is rich in ideas but hard to evaluate or test. On the positive side, there are new and exciting ideas in the prototype - one of them is the combination of close-range sound recordings and small loudspeakers distributed in the room. On the negative side, the ongoing negotiation between different artistic temperaments - which does not come to a conclusion within the prototype - ends up as a system that lacks consistency, and thus less accessible for children users attempting to learn and use the system.

The AudioTheatre is in this sense easier to apprehend. The designers have been asked to create content to a preexisting context. They have had a large amount of freedom to write and illustrate, but within the limits set by the concept. The AudioTheatre is also better suited to explore the research issues in the project, since it stages the reformulation of stories.

The reason that I have chosen to make the comparison is that I think it tells something about the differences between the qualities necessary to an art piece and to a prototype in a research project. If a prototype is made to test a concept, it is almost an advantage from a research point of view that the prototype does not present too much interest in itself. On the other hand, as an inspirational tool, when it comes to raising questions instead of answering them, the art piece can be useful as a catalyst and battlefield for creative collaboration.

ACKNOWLEDGMENTS

The Narrative Toys project is financed by the Swedish Foundation for Strategic Research through the Interactive Institute. Sanne Fraas, Designskolen Kolding, and Martin Rauff-Nielsen, Solit Entertainment A/S, have contributed largely to the design and implementation of the AudioTheatre. Staff and children at daycare centers Filifjonkan in Malmö and Garvergården in Copenhagen have been part of the testing, as well as colleagues at the Interactive Institute and their children. We want to thank Sara Roberts for proofreading and commenting this text.

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Evolving Stories

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ABSTRACT

New media technologies allow us to produce works which are complex systems rather than static objects, interactive works which require the participation of the viewer, and collaborative works over distance through the use of the Internet. Our research addresses these basic shifts and new opportunities in a wide array of applications such as: emerging models of database supported artworks, network-based interactive work, narrative as a temporal process and interactive installations and performances.

Keywords

Interactivity, non-linearity, community, participatory, broadcast, narrowcast, communal story, installation, women, medicine, digital, media, new media art, network environment, cyber culture, virtual environment, interactive database, interactive documentary, virtual presence

INTRODUCTION

Advances in digital communication technologies have had and continue to have a profound impact on all areas of communication and design. The first wave of applications concentrated on the development of powerful tools that dramatically changed the production process. The second focused on the development of enhancements to established communication and entertainment forms. The third wave will be in part the application of existing media forms and communication devices in a wide range of synthetic relationships. The hybrids produced during this period will by necessity generate new art forms and innovative communication and design systems. These hybrid forms call into question some basic assumptions implicit in our understanding of art objects and linear narrative structures.

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PROJECT

This research investigates open systems, propelled by the active participation of the audience, who, through the process, become authors as well. We are developing systems designed to elicit interaction and to inspire participants to add their own stories to existing narratives. These new multi-vocal image based stories, saved in a data-base, will then be interwoven into the original stories and sent out again. The stories are not only open ended - they literally never end. This is one of the most powerful opportunities afforded by New Media to conventional narrative structures. The emerging participatory, non-linear and evolving new narratives open up a wealth of possibilities for culture, communication and design.

One of our primary goals is to empower communities, across the country and around the globe to communicate in new and creative ways, providing a mechanism for building bridges among communities with common concerns. Ours is the exploration of the notion of the horizontal mosaic, where people who share a culture, a lifestyle or even a means of livelihood become part of a community that transcends geographical and cultural boundaries. Each of our projects build on previous ones, pushing the boundaries of the technology further each time and developing partnerships with more and more communities. Indeed the success of our research depends on establishing national and international partnerships.

Our research is innovative and experimental as it requires the development of new technological tools. This is particularly the case for interactive networked art and sensor-based works over distance. The intersection of art and technology itself makes the research innovative, not because this has never been done before, but rather the paradoxical relationship set in motion when art and technology meet necessarily pushes the limits of both, stretching the minds of the artists and scientists involved. There are similar research projects going on at several major research universities such as MIT but their focus is deeply rooted in established media forms. Our project seeks to break new ground by unleashing New Media's creative potential, particularly in the areas of investigating the emergence of new forms.

LILA'S STORY

My Aunt Lila: A Mad Documentary

Background

When I was a child Aunt Lila was only mentioned in whispers. It was not until I grew up that I discovered the reason for the secrecy. My aunt was in a mental hospital. Years later, long after she died, my sister told me that there was nothing wrong with our aunt – that her menopause had been misdiagnosed as manic depression.

The idea that my aunt was put in a mental hospital because she was a woman haunted me.

I began to write a screenplay about her. As research for the screenplay I made a documentary. Now I am creating an installation and interactive narrowcast around my aunt's story.

My sister was shocked when she heard about this project. She immediately denied the story and enlisted my other sister as co-conspirator in the cover-up. In the beginning, it was like pulling teeth to get anyone in my family to talk about my aunt. Consequently, the project has become as much about family secrets as it is about my aunt.

Silenced in life, Aunt Lila left few traces of herself. A portrait painted when she was in her early twenties triggers the often-contradictory memories her relatives have of her. From such insubstantial evidence, this project constructs a memory of Aunt Lila.

The Video

Through a series of interviews with family members different versions of Aunt Lila's life are constructed. The tightly framed direct address to the camera interviews add to the development of the constructed character, as well as paint a portrait of my 'real' aunt and reveal each participant's emotional relationship with her. Aunt Lila left very little behind. In life, she was silenced. In death, she remains so.

From inside the walls of a digitally built hospital the story reconstructs her memory and her history. A digital copy of a painted portrait is projected across her bed, spilling onto the floor like "a cut paper shadow"[1]. This image draws our attention to the manufactured characteristics of memory, spilling over the edges, never quite certain.

Reality breaks through the walls of the virtual space as Aunt Lila's daughters and granddaughter talk about her from the present tense location of the 'real' interviews. At times their voices overlap, blending into an indistinguishable texture where clarity vanishes. The images constantly move in and out of frame drawing our attention to the border between reality and what lies beyond.

Aunt Lila's Room

This site-specific installation, set up at Women's College Hospital in Toronto, Canada, is a conceptual representation of my Aunt's life. Roughly cut out windows reveal videotaped interviews from behind the walls of Aunt Lila's hospital room. Multiple and contradictory voices remember her life and the truth of her story lies somewhere in the mix.

While real visitors explore the installation, virtual visitors from a remote interactive narrowcast appear and disappear from a 'television' beside her bed. She responds via an oscilloscope atop the monitor.

Figure 1.Aunt Lila's daughters and granddaughter from behind the walls of the hospital room.

The Visitor

The installation shall be extended into a remotely accessible, interactive narrowcast, through a camera set up to capture the installation environment.

The image is then narrowcast to a monitor on a hospital cart in a gallery or in a hospital in another city. A camera and microphone hang from an IV pole allowing viewers to visit my aunt in the hospital.

[1] Plath, Sylvia. Ariel, Faber and Faber, London, 1965

Figure 2.The Visitor

The video feed from the remote location is analyzed by a computer, both to sense the presence/absence of the visitor and to trigger corresponding events in the installation.

Audience Participation

The audience will be invited to pay my aunt a virtual visit. The stories that the "visitors" tell my aunt will become part of the installation in Toronto. Their contributions will be saved into a database and incorporated into the content of the work. The story of my Aunt becomes a shared story, expanding the context to create a communal, open-ended narrative.

EMIL'S STORY

The nature and tone of the rhetoric that followed the events of September 11 were almost as disturbing as the events themselves. While this may sound cynical, to some extent it was as if the disaster provided justification for the intensification and escalation of the policies and pursuits that brought it about in the first place.

In response and within the context of the larger Evolving Stories Project, I created an interactive work that juxtaposes images of war, poverty and repression, records of interventions in foreign soil by the US Government with audio samples from speeches and statements in the ensuing months.

The visual metaphor is one of trying to scratch away at the surface of the event, represented by one image of the devastated World Trade Center, to reveal the elusive underlying context. The viewer is, however, frustrated in this effort, since the surface "skin" of the event constantly restores itself.

Figure 3.The devastated Word Trade Centre.

The cursor is hidden as the viewer tries to uncover the layers of information and to propel the piece forward.

Originally, the only quotes were from President Bush and Dr. Jerry Falwell. While the piece worked, I felt that it suffered from not making the distinction between the American people and the US government policies. So, I brought in quotes from a talk by Noam Chomsky given at the MIT Technology and Culture Forum, subsequent to the September 11 events. The addition of segments from this talk, interspersed with sound bytes from President Bush created a richer and far better-directed context. An analysis emerges from the 'conversation' surrounding the event.

Audience Participation

By the end of the piece participants find themselves included within it, introducing an element of performativity, as well as a degree of responsibility.

While the deconstruction of the images within the piece highlights the nature of information in the digital age, it also suggests the possibility of liberation, a useful metaphor for the future. The dialogical structure of the work is a model for the next stage of the project, where all sources are placed in a database, and participants will add new material and initiate new 'topics'.

The installation will consist of 2 webcams and 2 mice each connected to a computer networked to a 3rd computer.

The computers' screens are projected onto suspended screens in the room and two participants at a time interact with the projections.

INFORMATION AND QUESTIONS

For more information, contact Lila Pine at l1pine@ryerson.ca or Emil Kolompar at kolompar@ryerson.ca. More detail about each story can be found at the following web sites: http://imagearts.ryerson.ca/l1pine

http://www.ryerson.ca/~kolompar

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Building Cuthbert Hall Virtual College as a Dramatically Engaging Environment

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ABSTRACT

This paper outlines the interdisciplinary nature, collaborative work patterns and role of aesthetics in the *Cuthbert Hall Virtual College* research project at the Cambridge University Moving Image Studio (CUMIS) and the Centre for Applied Research in Education Technology (CARET). The project identifies key properties of dramatically engaging real-time three-dimensional virtual environments (RT 3D VE) and how the holistic experiential phenomenon of place is organised and mediated through spatial narrative patterns. Interdisciplinary by nature, the project requires a collaborative approach between science, engineering, media and architecture, and the results are revealing for all these areas. The *Cuthbert Hall* project invites discussion of the importance in the creation and use of RT 3D VE's - under single and multi-user conditions - of articulate aesthetics (the quality of architectural, visual and audio design; the production and incorporation of dramatic properties) and of the conditions required for collaborative, communicative use of the environment.

The full theoretical and technical discussions as well as the evaluation results are outside the scope of this submission.

Keywords

Real-time virtual environment, computer game, place, architecture, mediation, narrative, expressive space

VIRTUAL CUTHBERT HALL PROJECT

Assumptions and Concepts

The *Cuthbert Hall* project proposes that 'place', a fundamental archetype of human consciousness [1] and a holistic experiential phenomenon that is irreducible to its components [6] [8], may be used as the primary principle for the construction of Virtual Environments (VE's) and can serve as a criterion by which to judge their success. To complement the specificity of place, narrative, reinforced by a wealth of dramatic techniques from performance, literary and moving image arts, can introduce meaningful structure to VE's, which makes them engaging and effective as a forum for sharing and generating ideas. *Cuthbert Hall Virtual College* is an interactive RT 3D VE 'stage' [5] where spatial narrative is collaboratively created through active user participation. As such, it seeks to explore how the integration of narrativity and architecture can expand the potential of RT 3D VE's for dramatic engagement, for use in collaborative design, research, education, communication and drama.

Implementation

The *Cuthbert Hall* project investigates, identifies and formulates spatial definition, event structure and effective mediation in RT 3D VE's by creating two environments, *Plowman Court* and the *Boethius Room*, within the context of the virtual college of *Cuthbert Hall*. This college is conceptually defined in reference to a traditional Cambridge College, a place for learning and teaching with a specific character expressed in its architecture as well as its statutes, teaching and learning practice. In creating this virtual place, mediation techniques from established fields (such as cinema, television and sound design) are transformed and combined with interactive access to enhance the conditions of RT 3D VE's.

The fictional pedigree of *Cuthbert Hall Virtual College* combines factual episodes from the history of 'real' Cambridge colleges with imagined stories. For our purposes, History is made to tell of the foundation of *Cuthbert Hall* in the 15th century, and later of its subsequent disappearance from the cityscape - and the records - for complex political reasons. Today the RT 3D VE makes this college accessible 'again' – virtually.

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The content operates on several narrative levels, defined through the spatial layout of the college, the means of mediation and the visitor interaction with the VE. Combined, these elements create the experience of place, parallel to the experience of belonging to a real Cambridge college, with its history, personalities and architecture.

The *Cuthbert Hall* project suggests that this experience of place, enhanced through spatially expressed narrative, not only improves the visitor's engagement with the VE by providing a meaningful exploratory experience, but also inspires stimulating interaction between multiple users. Visitors can meet in the virtual college of *Cuthbert Hall* to exchange ideas or news, participate in one-to-one academic supervisions, or have a tour.

Plowman Court:

Navigable Expressive Space and Spatially Organised Narrative

Plowman Court incorporates an open courtyard, a central feature of all Oxford and Cambridge colleges, and generates evocative memory pictures staged within a nocturnal exterior environment. While the spatial structure remains constant, audiovisual encounters within the environment add narrative context to the space, making it meaningful for a visitor, who can discover various dramatic events illuminating the life and history of the college. The underlying narrative pattern is based on symbolic activities - historic, social and scientific: such as 'Bumps' (rowing boat races), 'May Balls' (celebrating the end of examinations) or scholarly debates. The spatial as well as conditional organisation of these dramatic scenes uses trigger zones to activate site-specific audiovisual effects. A visitor to *Plowman Court* is free to explore the virtual environment, and in so doing will set off the scenes embedded there, thus generating an intrinsically non-linear narrative that crystallizes during and through the exploratory process.

Figure 1. Cuthbert Hall College - main gate.

The Boethius Room:

Temporality and Spatiality Fused in a Narrative Form

The *Boethius Room* consists of five variations on a single room, which manifest in different historical periods. Perceptually, in the spatial dimension, a visitor can step from one 'room' to another, while structurally, the architecture remains the same – it is only the temporal positioning that changes. Rather than through an incremental process, the *Boethius Room* VE unfolds through a series of instantaneous metamorphoses, not unlike cinematic temporal or locational continuity 'cuts'. For the visitor, a change in space generates a change in time. Each time/room features a distinctive set of textures, time of day, lighting, camera strategy, soundscape, weather condition and effects. The dramatic impact, then, comes from instantaneous juxtapositions of contrasting time, space images and events that build up towards a meaningful whole, not unlike montage technique in cinematic editing.

Technical specifications

The *Cuthbert Hall* environments are implemented as easily accessible low-cost onscreen RT 3D representations, which use game-engine technology, and feature textured and animated geometry, sound and visual effects. Navigation is by keyboard and mouse. The two 3D engines used are *Zanzarah* (Funatics)/*Renderware 3D* (Criterion) and *Serious Engine* (Croteam).

WORK PATTERNS: BUILDING CUTHBERT HALL

Challenges

Creating *Cuthbert Hall* demanded working procedures that could blend knowledge and techniques from the areas of art, design and academic research. One major challenge in the design of holistic spatial environments for digital media is the lack of natural or specific locational context, the 'given' that traditional architects interpret and imbue with significance when they design a built environment. Another inherent problem arises from the exploratory freedom, given to the user who is not constrained by pre-specific pathways or timeframes, that makes saturating VE's with adequate detail difficult.

Solutions

Design

Spatial structure and narrative context are closely intertwined in the design of *Cuthbert Hall* and cultural references establish initial contextualization. Explained through narrative, spatial patterns can be considered products of historically located social practice that can be defined and re-used as recognisable 'social space' [4]. This space is further enriched with dramatic samples of the relevant social practice borrowed from (or based on) written and oral history.

Its architectural design puts the virtual college, *Cuthbert Hall*, into relationship with the social space of Cambridge, drawing inspiration from existing colleges; while the narrative arranges the dramatic scenes in patterns that relate to the social life of Cambridge University. The combination of architecture and narrative generates the necessary context for the design of expressive narrative space, a prerequisite for turning virtual space into virtual place. The detailed practical design of the environments includes the definition and placement of dramatic scenes, thematically distinct zoning and scenic effects (such as lights, fog, and animations).

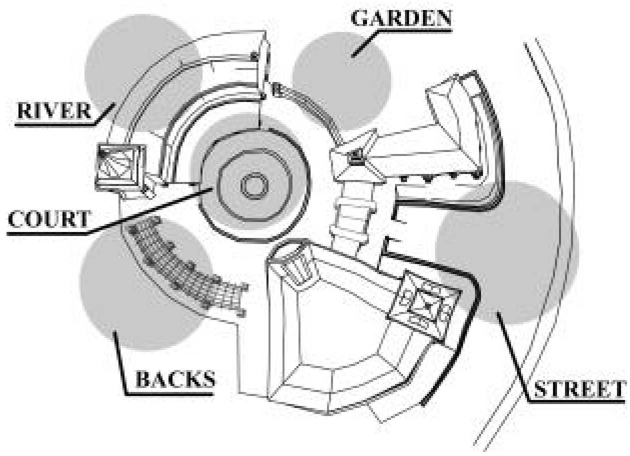

Figure 2. Spatial zoning with distinct characteristics.

An efficient workflow with continuous feedback demands continuous RT testing of these elements, and this proved to generate a looping process, not unlike that of 'graphic thinking' [2] [3], which was effective in rapid idea generation, exchange and evaluation.

Content Creation

The need to endow the *Cuthbert Hall* virtual environments with emotive impact brought together artistic contributions from a wide range of traditional arts. Imaginative input is provided by a number of contributors, each well-versed in their respective arts.

The *Virtual College* project needed artistic contributions from:

- **Literary arts.** The imaginary life of the college involves epic narration, character-stories and scenarios.
- **Performance arts.** The interactive scenes require the skills and imagination for character animation and voicing, plus the sensitivity of a theatre-director for dynamic staging (*mise en scène*).
- **Music.** The interactive soundscape merges the composing with the intricate craft of a sound designer.
- **Architecture.** The aesthetics and meaning of the spatial setting call for ingenuity in the architect to work with form and cultural allusions, while lighting, textures and effects require the skills of a painter.
- **Editing.** Expressive camerawork is impossible without the experience and individual creativity of a moving-image editor.

Such a diverse range of artistic languages and practices in the context of a research project inevitably generates a good deal of creative friction, over the disjunctions - i.e. art vs. research, art vs. technology and design vs. art. At the same time, the established collaborative arts of theatre (particularly improvisational drama) and cinema, where flexible teams are built on a per-project basis, and the diverse artistic and technical talent provides multipotent creative resources, provide successful work models.

The process of developing the *Cuthbert Hall* VE as a coherent place highlighted the importance of aesthetics in the media fusion that makes possible dramatically engaging RT 3D VE's. The framework of a doctoral research project imposes strict constraints on time, budget and equipment. However, even if in a limited way, the aesthetic standards to which the project aspires had to be actually implemented before the VE could serve as an effective proof of concept.

Many research projects in VR are built using placeholders instead of full-quality material, an approach that limits the effectiveness of coherent expressive language and thus of the sustained dramatic engagement which the project aims to test. The *Cuthbert Hall* experiment reinforces the contention that in the conceptually and technically complex field of interactive RT 3D, R&D into technological foundations cannot be separated from continuous artistic input and reinterpretation. From the ground up, these processes need to work in parallel. Only in a situation of constant cross-fertilisation among members of a collaborative design team, can appropriate concepts, techniques and tools be developed for efficient research and inspired artistry.

OUTLOOK

Cuthbert Hall Virtual College constitutes Phase 1 of the *Haven* research project at CUMIS and CARET, an ongoing investigation into the use of RT 3D VE for collaborative design, research, drama, education and communication. The *Cuthbert Hall* practice-based research project has established collaborative techniques and methodologies for content creation that promise to be of immediate use within these target areas.

The workflow and method of design developed on the *Cuthbert Hall* project were tested in February 2002 as a workshop (*The Casablanca Experiment*, Nitsche) for graduate students on the 'Architecture and the Moving Image' MPhil-degree at Cambridge University. Using it, they proved able to develop a dramatic scene, model the virtual stage, texture it, import it into a RT engine with avatar characters, and, finally, collaboratively rehearse and stage a dramatic performance – all within three days.

Another application is in the process of architectural design, especially within the framework of a large-scale long-term architectural development where alternative design ideas can be tested against the background of a pre-built model of the environment, as in ongoing work on the *Virtual West Cambridge Project* (Roudavski), a part of *Web-Based Participation for Campus-Scale Project Design* at the Martin Centre for Architectural and Urban Studies, Cambridge University [7].

RT 3D VE's depend on collaboration between artists, designers and engineers. Practice-based research in the design of *Cuthbert Hall Virtual College* is an example of this process on the scale of an academic PhD-level project. The initial research focus upon the amalgamation of architectural expertise in place creation with narrativity and cinematic *mise en scène* as a means of creating dramatic engagement in RT 3D VE not only defines the project's content, it also guides the design and production processes.

CREDITS

Software support: Criterion Software, Renderware 3D engine; Funatics Game Development

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Concept/direction/scenes/architectural design/camera: Nitsche, Roudavski

Background story: sketched with the help of historian Elisabeth Leedham-Green, Cambridge, UK

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Character Animation: Funatics animators, Mülheim, GER

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The Picnic

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ABSTRACT

In this paper, I discuss a collaborative, interactive public art project called ***The Picnic*** that was performed simultaneously as an event in various locations. This paper examines relationships between conceptual art and community building practices by using *The Picnic* as a model of a participatory art practice that connects people, places and ideas of urban cultural activity.

INTRODUCTION

My name is Caroline McCaw and I live in Dunedin, in the South Island of New Zealand. *The Picnic* formed part of my studio research for a Masters of Fine Arts for which I hope to complete the thesis writing this year. I am a graphic designer, an artist working in time-based media and a University teacher as well as a student. I manage a weekly publication and I have a five year old son. I am also an activist on local and national arts advocacy and employment issues. At home I am the self-appointed activities officer. All my work activities have in common a commitment to a kind of cultural practice which aims to include the reader or viewer as a collaborator through their experience of the work.

In this paper I discuss aspects of *The Picnic* to describe some of the ways and means that my cultural practice takes shape.

THE PROJECT

The Picnic can be described as a multimedia art event or series of happenings during a four hour period on October 14 2000. *The Picnic* event was situated in four urban locations around New Zealand, with a live performance webcast from Amsterdam.

There were over 70 artists who installed new works, interactive environments, or set up games or performances for the day, all loosely based on the theme of a picnic.

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The Picnic was group negotiated conceptual art with very physically located manifestations which the audience as “picnicker” visited, in some cases identified or played with, in other cases drank tea with.

Each site worked differently. Encompassing four cities (small in international terms) and a port town, it was impossible for any one person to see every work. Some works were very temporary, and distances between the cities were large. It was even impossible to arrange for every work to be photographed; people in each city engaged with the event very differently, different cultures with different urban rules.

I was in Dunedin on the day so as a brief introduction, my description of the project starts as a snapshot of my experiences.

In Dunedin the events began at Arc Cafe, a cafe and local arts venue that also acts as a kind of meeting place for people involved in the arts community.

The cafe also offers five free internet terminals, and so created a site for exploring the picnic's digital side, a website with digital works and an online text-based environment known as a MOO or a MUSH, which loosely described the trails of works in the various cities. Each of the cities had identified public access internet for this associated online exploration.

To begin with potential picnickers gathered at Arc Cafe to watch the live webscast from Amsterdam then picked up event maps and began a walking trail through the inner city, starting with performances in an installation upstairs at the Blue Oyster Gallery. There is a surplus of inner city office space in Dunedin and the building that this cafe and gallery are housed in is otherwise fairly empty.

For *The Picnic* a number of artists had set up in empty rooms in the building: a nylon fabric maze, a contemporary dance, performance art and minigolf. There was also a children's event at the cafe’s venue, called the Teddy Bears’ Picnic which coincided with a children's birthday party that had also been booked in the cafe on that day. Picnickers spent about an hour exploring the activities in the building, before following walking trails to find works which had been installed in public places around the inner city. A light wind had meant that some of the works had been relocated into more sheltered spots. This enhanced the aspect of discovery, and in most cases green fluorescent posters (mimicking street signs) pointed the way to help picnickers at intersections. Mostly though, picnickers themselves had to negotiate and decide when it was they had reached a picnic place or had entered the fiction.

Art as a Collaborative process

In all my work, as a graphic designer, artist and educator, I value and incorporate collaborative processes. As an arts publication designer this has taken shape by employing post-structuralist theory and methodologies, to use the written text as an open rather than closed structure, and using design practices such as collage and cut-up, to employ free-floating compositions which require negotiation by the reader, and a personal contribution to complete the relationship of "written" and "read".

The Picnic as an art project also employed methods akin to the cultural production used by the media. We produced our own media: posters, stickers, flyers and maps, and documentation of the event and works (the only way an audience or participant could experience the breadth of all the work and activities) were produced as a book and interactive CDROM (on display at the PDC exhibition).

Both the event's production and "consumption" were the result of collaborative processes. As curator I relied on artists in various locations to collaborate and the event was the sum of the artists (unnamed) works. Likewise the audience became collaborators, participating in enacting the concept of the event, and in the recognition of *The Picnic*, both as an event and as a collection of works.

The Picnic encouraged multiplicity and metamorphosis both within the art objects and processes and the viewers' experiences of them. As a cultural process *The Picnic* produced conversations as a tool to help picnickers make sense of their experiences, both current and in memories.

In Dunedin small crowds of picnickers gathered and on discovering new public art experiences, told stories about picnics they had been to and how the day's event and experiences compared. Spontaneous picnickers joined in at the event, both artists and audience. It was difficult at times to tell pieces apart, which parts were nominated art works, and which parts were coincidental...just like our memories when we story tell, sampling aspects from other stories, and tales which leak into the next chapter. An example was a tent expo erected on a traffic island in the centre city which many picnickers assumed was an elaborate art environment, but really was a trade display. New Zealanders are really fond of camping, and the tents served as an identification prompt in the same way as the works of art.

In Regards to Aesthetics

The works and artists of *The Picnic* were connected by the theme of a picnic, but one set in the streets of the city rather than the more traditional park or countryside. The works and activities therefore were a way of reinscribing urban spaces and artists relationships with each other and with potential audiences. The use of new media and digital environments further enhanced a type of relationship which may be distant yet intimate, a conceptual way of knowing through simultaneous yet geographically distant textual relations.

In the 1960s conceptual artist Vito Acconci began to infer interaction with the audience by using the gallery space as a community meeting place. Acconci said: "[By choosing to] use the gallery space as the place where art actually occurred…I was shifting my concentration from "art-doing" to "art-experiencing": an artwork would be done specifically *for* a gallery- in other words, for a peopled space, for a space in which there are gallery goers. The gallery, then, could be thought of as a community meeting place, a place where a community could be formed, where a community could be called to order, called to a particular purpose."[i] *The Picnic* literally "performed" Vito Acconci's idea of using the peopled aspect of a gallery as site. (Although in the case of *The Picnic* many of these "sites" were shifted from the traditional gallery to the street.) The art work shifts position and register from a noun to a verb, requiring action to be complete and as a result the works also shift in ownership. For Henry Sayre there is a paradoxical experience of the (absent artists')/work for the audience, which may be recognized as a shift in emphasis and experience from the (art) object to the (art) experience.

In this sense the aesthetic qualities of the art works were not necessarily recognized in relation to each work as a discrete art object (nor necessarily its named creator), but in how works contributed as recognition devices, both in relation to the project's theme and in the urban context of a series of public art works.

The Picnic can also be seen as a New Zealand style urban manifestation of the Fluxus idea of intermedia, which Dick Higgens described as "work whose structures determined the textures of the spaces between media" [ii] This means *The Picnic* allowed the textures of urban habitation/experiences to be examined through the conceptual relationship of art works and performances, inscribing a way of creating social action and life activity as aesthetic terms of value.

In the case of *The Picnic* some aspects showed how this process can be identified, even when it isn't "working" in the way it the artists intended. In Wellington, New Zealand's capital city a Dunedin artist, Layla Rudneva Mackay had flown up to install and document the event. Wellington as a picnic destination was however plagued with theft. The maps and posters which were sent by courier days in advance were all stolen, after being delivered to the wrong address. The works too were stolen quickly by passersby, and although we didn't expect them to be left at the end of the day, the speed of the theft was surprising. Layla often had to run to take a photograph in case works were stolen before she had finished setting up her camera. In other cases security guards would clean works away immediately as in the case of the works placed outside Te Papa, The National Museum of New Zealand.

Meanwhile in Dunedin some people were beginning to complain. "This isn't a picnic, this is a wild goose chase!" grumbled one woman, who nevertheless was catching the free bus to Port Chalmers to find out more. Port Chalmers is a small old settler town, still kept alive by the shipping activity. The activities here were focussed at first in the local Town Hall. Musicians played and a beach theme prevailed, and people sat in the sun, drinking beer, and trying to decide if today the picnic experience was true to their personal stories and expectations.

In both these situations whether or not the public were responding in ways intended by the artists, their experiences nevertheless involved aesthetic recognition and negotiation as well as social activity, as a result of the art event.

In terms of Interactivity

In terms of interactivity *The Picnic* as a conceptual art practice is also a very urban one, a way of reinscribing (through art actions) a social relationship with the city. *The Picnic* incites public art action, using the city as a place to reinscribe cultural action activating viewers as participants in picnic-like activities. A picnic after all is not the type of event where one can attend as an audience member alone. When one accepts the invitation to join a picnic, as a social ritual, it is with the inscribed willingness to participate in that ritual, to become a member of that cultural grouping, albeit temporarily.

The Picnic through creating art trails through urban spaces encouraged artist and audience alike to participate in a Situationist derive-type experience which became a new way of experiencing relations with the cityscape.

My experiences of the event have led me to reflect on the idea that community-building practices which result from interactivity are probably more successful in person-to person situations rather than through the media of connected computers, but once again, media-like relations have popularised a type of relationship (between people in different locations, sharing and understanding or "reading" of signs) which *The Picnic* as an art event sought to utilise. A community is "called to order" to enact the works, which became an empowering activity, providing a sense of possibility and exchange.

Nick Stevenson introduces the concept of cultural citizenship which is participatory and open to critique. "The power to name, construct meaning and exert control over the flow of information within contemporary societies" begins at a local level. He asserts that we should seek to form an appreciation of ways in which "ordinary" understandings become constructed, as a way of reclaiming the production of culture.[iii]

At the Dunedin Railway Station a group of winged and feathered performers built a small fire in the foyer and began brewing a huge pot of tea. A number of tourists gathered around and waited for the tea to warm, Japanese tourists who had arrived by train, and senior citizens who had waved friends off at the bus waited and chattered together, while butoh dancer "Seagull Monkey Horse" and several musicians, settled lightly to entertain them. Real seagulls gathered outside on the Railway Station lawn to sqwark at life-sized seagull models made out of slices of white bread squashed and moulded into seagull shapes. Eventually the performers and tourists were all able share together in the social ritual of drinking tea.

But I am telling you stories.

The Picnic was a sprawling and uncontrollable storytelling machine, and no matter who you talk to from the estimated audience of over 1000, you are bound to hear a tale which is quite different from any other.

In conclusion, *The Picnic*, through the use of conceptual and installation art practices, created an event which required participation at numerous levels, both conceptually, through active identification and through storytelling. The cultural actions produced by the event may be ongoing, enabling a rewriting of similar activities in urban spaces, and reproduced through conversations by the many audiences who participated, and through their activities "completing" the works.

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[ii] Friedman, Ken (ed) The Fluxus Reader, in Part 2 Theories of Fluxus ‘Zen Vaudeville: A Medi(t)ation in the Margins of Fluxus’ by David T Doris p91, Academy editions, 1998, Sussex, UK

[iii] Stevenson, Nick (ed), Culture and Citizenship Sage Publications, London UK, 2001 (from the Introduction by Nick Stevenson)

Litter (polystyrene rocks) by Douglas Kelaher, outside Te Papa, New Zealand’s national museum, Wellington.

Space Lounging (live webcast performance) , a Loop & Empress Production, Amsterdam.

Tea Party (interactive performance and installation) by Pipi and friends, Dunedin Railway Station, New Zealand.

Picnic Signage (fluorescent green posters) by Caroline McCaw, identifying directions and exhibits, New Zealand.

52 Events. A Participatory Art Work

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ABSTRACT
This presentation describes a participatory art project initiated in the 1960s for publication by the international laboratory for intermedia art known as Fluxus. The project has been realized again in the 1990s using the World Wide Web.

Keywords
Events, scores, intermedia, Fluxus, participatory art

INTRODUCTION
This is report presents a participatory art project that began in the 1960s. The project was participatory from the start. The element of participation grew over the years as the artist effectively transferred artistic control and realization of the works to the audience. In most cases, works that were once shared by artist and audience now depend completely on audience participation for their realization.

The call for papers to this session asked two questions, "To what extent can art be participatory? Where is the border between art and design?"

The first question is an artistic question. The second is scientific. Because this session is effectively a poster session with a short supporting paper, I will answer the first question and demonstrate a specific project to illustrate the answer.

The project is titled *52 Events* (Friedman 2001). The project began when publisher Paul Robertson of Heart Fine Arts in Edinburgh, Scotland, contacted me. He asked me to create an art work in calendar form for the year 2002. I agreed to create a calendar edition of selected event scores selected from the 1950s through the 1990s.

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A dialogue between publisher and artist led to a plan to realize a calendar in diary form. In addition to a signed, limited edition of 250 copies, we agreed that Heart Fine Art would create an open edition in .pdf format available for download from the World Wide Web.

The earliest works in this edition were originally gathered in 1966 for publication in the spring of 1967 as a Fluxus edition titled *Events by Ken Friedman*. Edited and designed by George Maciunas, the 1967 Fluxus edition waited on a large-scale printing order that never materialized (Hendricks 1989: 251-258, Maciunas 1967). While waiting for the Fluxus edition, I began exhibiting event scores and circulating them in small editions of various kinds.

In 1973, the University of California at Davis organized an exhibition exclusively composed of my event scores. This exhibition marked the first time that an artist presented an exhibition comprised solely of text-based event scores. The exhibition toured the world in the 1970s, with editions of scores appearing in English and in translation.

When the premature death of George Maciunas ended the Fluxus publishing program, I continued to work with the event structure, adding to the corpus of events in a continuing series.

The call for this session asked several questions that can be answered by direct empirical evidence. One involves practice-based research and participatory art. I will not address the scientific questions regarding research, but I will address the question in relation to participatory art.

The question is, "Can participatory systems create artistic work whose aesthetics and originality place it in the same league as pieces produced primarily to demonstrate creative talent, qualifications and skill . . or work intended purely for

Monday
June
3rd

Tuesday
June
4th

Wednesday
June
5th

Holy Bird of Finland

July 1991, Helsinki

An installation or book presenting images, objects, stories, riddles, puzzles, and jokes having to do with cuckoos and cuckoo lore. Contents of either a book or installation can include: pictures of cuckoos, legends about cuckoos, recipes for cooking cuckoos (roast cuckoo, baked cuckoo, cuckoo soup, cuckoo salad sandwich, etc.), encyclopedia entries, ethological descriptions of cuckoo behaviour, descriptions of how people can emulate cuckoo mating rites, dictionary definitions, the word cuckoo translated into different languages, etc.

An installation can also present: cuckoo clocks, stuffed cuckoos, cuckoo toys, a diorama showing nesting cuckoos in the natural environment, videotapes or films of live cuckoos, a recording of the sound of the cuckoo in the forest.

exhibition or cultural production?"

The history of this project demonstrates that this is possible. Various editions of the events scores in this project have been exhibited in solo exhibitions in over 50 museums and galleries. These have notably included the University of Colorado, Centro de Arte y Comunicacion, Immediate Gallery, Ecart, Galeria Akumulatory, Fiatal Muveszek Klubja, Gallery S:t Petri, The Everson Museum, Washington Project for the Arts and P.S.1 in New York, now a division of the Museum of Modern Art.

The call for papers specifically addresses two issues in artistic development. One is the theme of art as process, collaborative authorship, and interactivity. The second involves technology.

While the current version of the project is indeed enhanced and transmitted by computer and Internet, this is secondary to the conceptual and participatory issues. In a white paper supporting an EU research project on multimedia (Friedman 1998b), I have discussed my view on what can sometimes become a form of technological intoxication. Instead of focusing on technology, I advocate using information technology in ways that may be as ancient as they are modern (Friedman 1998a, 1999).

THE IDEA OF THE SCORE

This project draws on the idea of musicality in visual art and intermedia. This idea has several implications.

It means that a work begins as an idea that is transmitted through a score. It means that the work resides in the idea, in the score and in the realized project. The work is equally present in each form, though present in different ways. It means that a realized project is only one interpretation of the work. It means that any work may have several valid realizations. Each realization represents the creative interpretation of the artist who realizes the work, in addition to the many possible receptive interpretations of those who experience the realized work. It means that a work may be realized by individuals other than the artist who creates the idea and embodies it in a score.

The score uses written notation to communicate instructions for realizing a work of art. The idea and use of the score is originally rooted in music. In visual art and intermedia, the score offered a way to transmit non-musical art forms. It became a method for encoding, recording and transmitting art forms.

From its basis in music in the strict sense, the idea of score in its extended form gave rise to the issue of musicality in an extended sense. This extension has important implications.

The first of these implications is that the work may exist as work in several forms:

-- as idea

-- as score

-- as process

-- as object.

Each of these forms has its own value and meaning.

The idea is pure, simple and inexpensive. It is easy to store, but difficult to preserve. Ideas are subject to change, to memory loss, to message failure and to interference. For the vast majority of human beings not gifted with telepathy, ideas require a physical medium for transmission -- if only a voice, a pen or a telephone.

The score reduces the possibility of change, memory loss, message failure and interference, while retaining many advantages of cost effectiveness. At the same time, storage adds a modest physical task as the price for exact preservation. While preservation records the score, it does not address the challenge of interpretation with the possibility of multiple interpretations or even of misinterpretation.

Process offers yet another way of understanding work. In orchestral music, theatrical or time-based arts, process is the preferred way to experience work, through live or recorded performance. The advantage here is the most complete possible realization of an interpretation. The disadvantage is linked to the time-bound nature of any physical process. Before the age of recordings, no experience could be repeated. Even in the age of recordings, the ability to experience several aspects of a piece at once or in comparison -- as is possible with ideas, scores or objects -- remains difficult, linked to expensive equipment. Creation of live performance is time-consuming and often expensive. Creation and storage of process in recorded form is an expensive, capital-intensive medium. Although individual recording, storage or playback units are no problem in the industrial world, making them demands a certain kind of society to spread the investment and effort over thousands of financiers and industrialists, millions of producers and billions of consumers. Logistics, transportation, storage, presentation and related issues provide their own difficulties for art forms not traditionally seen as time-based. These include the forms of object-making and presentation now summed up under terms such as process art and arte povera.

The object is another form. We all understand objects or we think that we do. We feel that the interpretation frozen in an object is the interpretation chosen by the artist but the object obscures the myriad possibilities that are rejected when the object takes final form. The object suggests an aura of permanence. It hides the process of its own making and it evades the issue of process that it requires to find its final shape. Storage, transportation and -- even for the object -- physical change remain problems. This is also true of the objects left behind by process, such as recordings.

Many artists now use scores in works that are touched by the spirit of musicality and many of them find these basic implications acceptable. I assert that musicality has richer and deeper implications.

To understand the potential of score-based work, it's useful to consider how music is transmitted and performed. The composer creates the score. Once the score leaves the composer's hand in published form, the composer has little control over how the music is realized or interpreted. During the period covered by copyright, anyone has the right to perform the music with proper notification and on payment of fees and royalties. Not even that much is required after the copyright expires.

The performer determines the interpretation and the composer is obliged to acknowledge authorship even when he or she despises the realization. No matter how good or bad a performance of *Don Giovanni*, it is always Mozart. The thinnest *Ring Cycle* is still Wagner. Everyone within reach of a radio has heard some of the more than 200 versions of Bob Dylan's "Blowin' in the Wind," ranging from Dylan's own protest-inflected ballad to the saccharine orchestrations created for Muzak and elevators. There have been disco versions, blues versions and even a pompous, inflated symphonic orchestration. Beethoven done for disco and Beatles gone baroque are still the work of their respective composers. The royalties on Beatles tunes must be paid to the rights-holder -- Michael Jackson. Neither Jackson nor Paul McCartney can forbid Eleanor Rigby from being used as a marching tune for an armored infantry division. McCartney had no luck preventing Jackson from granting permission for an automobile company to use one of McCartney's songs in an advertising campaign.

To compose is to give up certain rights. One right that a composer loses is the right of absolute control over the use and interpretation of the work.

In score-based work, I assert that the artist must naturally give up a certain element of control. Certain issues fall under the scope of moral rights in copyright jurisdiction or art law. Barring violation of those rights, score-based work inevitably opens a wide opportunity for variant interpretations. The only right that cannot be stripped away is the right of authorship. While the creator may wish to disavow badly realized work from time to time, the work must be acknowledged even if only to acknowledge a bad realization as a bad realization.

FROM CONTROL TO PARTICIPATION

Before 1966, I wasn't an artist. I built things, made objects, undertook actions. I engaged in processes, and I created and enacted events in the physical sense of the term. These were simply things I did. I didn't have a specific term for them. I didn't call them art. They were philosophical explorations or spiritual quests.

George Maciunas introduced me to the idea that what I was doing was art and he introduced me to a vocabulary for the kind of art I was doing. He suggested I score and notate the projects, actions, objects and constructions I described to him. This brought about the first large group of my scores.

In the 60s, I lived and worked in places far from the centers of activity where my work was shown and performed. It was an era when few people made this kind of work and very few were interested in realizing it. Often, the people who wanted to realize exhibitions and projects didn't have transportation money or project funds. My work had be done at a distance, with others realizing and interpreting my pieces. This, too, occasioned many scores.

The introduction to a new medium was one reason I began to work from scores. The need to create work for realization at a distance was another. The opportunity to create work in an experimental way, to take part in the way others might interpret my work, to see what would evolve was a third.

The obvious often hides the significant. In recent years, changing conditions have sharpened my focus on the issue of musicality. There are many reasons:

I am often invited to create projects far from my home in Sweden. People invite me to come these days, but I still do a great deal of work at a distance. Scores allow for work from a distance, enabling projects to be realized as I travel between hotel rooms and borrowed studios. The fact that I go to many of my shows now gives me the chance to experience my own work. There are pieces of mine that I've never seen and now it's possible. The opportunity to examine and to contemplate the scored pieces offers a new opportunity for philosophical exploration.

The issue of musicality has fascinating implications. The mind and intention of the creator are the key element in the work. The issue of the hand is only germane insofar as the skill of rendition affects the work: in some conceptual works, even this is not an issue. Musicality is linked to experimentalism and the scientific method. Experiments must operate in the same manner. Any scientist must be able to reproduce the work of any other scientist for an experiment to remain valid.

As with other issues in Fluxus, this raises interesting problems. Collectors want a work with hand characteristics, so some Fluxus works imply their own invalidity for collectors.

I take a more radical view of musicality than many of my colleagues: I assert that anyone may realize my work from the score. I will acknowledge it, though there is a difference between acknowledging the work as mine, however, and approving every realization. Some directors work closely with the playwright. Some conductors consult the composer. Someone who wants to realize my work may find it useful to consult me. At the same time, I recognize that someone may develop a wonderful interpretation of my work that I hadn't created in my own interpretation. There is always the possibility that someone may realize a work better than I have done. Musicality implies all these possibilities. My intention is necessary to the work. My interpretation may not be necessary in the same way.

Not all artists involved in Fluxus agree with me on the issue of musicality. Interesting enough, some of the strongest objections come from artists trained as composers. The artists who might particularly be expected apply the criterion of musicality to their work on theoretical grounds reject the concept in practice. There are two main reasons.

One is control. La Monte Young now refuses to publish his scores. He seems to believe that his work should be realized in only one interpretation, his own. Even though that interpretation may change frequently, Young stresses very specific notions of intention that must be brought out in each realization of the work.

The second issue is the market. Many artists feel that if anyone can realize authentic versions of their work, they will have nothing to sell. I have confidence that my interpretations are lively, valid and interesting enough for people to want them. Artists who have pieces fabricated by precise, industrial means may have more to worry about.

While new approaches to the realization of the work may become valid, I retain the copyright on my work primarily for the purpose of credit and moral right. The work is a philosophical contribution. It is freely available for realization and consideration as idea, as spoken word or as realized project.

Musicality in art raises interesting, profound questions. The issues are even more intriguing now than in the 1960s. Global politics and world economies are undergoing transformation, and with them, global culture. The art world has moved from the rebirth of painting to the birth of a grotesque new materialism at exactly the same moment that a new humanism is blossoming. The boundaries between art and many other fields of endeavor -- music, design, politics, to name just a few -- have dissolved. More and more people have come to understand the useful distinction between the valid concept of experimentalism and the reactionary concept of avant-gardism. In these exciting times, the implications of musicality, the consideration of meaning, intention, realization and interpretation that musicality raises, are among the most lively and interesting.

INFORMATION AND QUESTIONS

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Tangible Viewpoints: Physical Navigation through Interactive Stories

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ABSTRACT

Over the centuries, stories have moved from the physical environment (around campfires and on the stage), to the printed page, then to movie, television and computer screens. Today, using wireless and tag sensing technologies, researchers and storytellers are able to bring digital stories back into our physical environment. The Tangible Viewpoints system explores how physical objects and augmented surfaces can be used as tangible embodiments of different character perspectives in an interactive tale. These graspable surrogates provide a direct mode of navigation to the story world, a means of bridging the gap between cyberspace and our physical environment as we engage with digital stories.

Keywords

Tangible interface, interactive narrative, collaborative storytelling, physical interaction, multiple point-of-view.

INTRODUCTION

Across the centuries, scientific research and technological innovation have enabled the development of new mediums for creative expression and storytelling. However advancement in technology alone is not enough – the path that leads to a stable artistic medium begins with a period of experimentation, during which researchers and artists work to uncover the creative potential of the new technology. Equipped with an understanding of past conventions and a vision for the future of art, these "new medium pioneers" gradually define an expressive language suited to the emerging delivery channel. As such, we have seen stories transition from the physical environment (around campfires and on the stage), to the printed page, then to cinema, television and radio, and finally onto our computer screens.

These days, in many art institutions and research labs around the world, artists, designers, storytellers, computer scientists, and engineers are working together to create new types of interactive story experiences. Breaking free from the fixed nature of more traditional expressive and narrative mediums, and putting greater emphasis on the dynamic quality of the experience, their pieces undermine the notion that artworks must be centered on a single "author". But merely including the opportunity for interaction into their systems by no means guarantees an engaging narrative experience for users. As artist/researcher Stephen Wilson points out, "The same careful design and artistic inspiration will be necessary to make the processes of interactivity themselves key artistic or conceptual elements." [9]

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Figure 1. The graspable objects in Tangible Viewpoints.

In the Interactive Cinema and Tangible Media groups at the MIT Media Laboratory, we are exploring how screen-based digital stories can be brought back into our physical environment. This paper introduces Tangible Viewpoints, an interface for multimedia storytelling that explores how physical objects and augmented surfaces can be used as tangible embodiments of different character perspectives in an interactive narrative. The graspable surrogates provide a direct mode of navigation to the story world, helping to bridge the gap between the realms of bits and atoms within the field of interactive storytelling.

This paper begins by providing a context for the research from the perspective of tangible interfaces and multiple point-of-view stories. We then give an overview of the Tangible Viewpoints functionality and discuss how the system has been used for collaborative storytelling and exploration.

CONTEXT AND RELATED WORK

The Tangible Viewpoints system combines the use of tangible interface technology with a multi-viewpoint approach to storytelling. We believe that these two elements are synergistic and can work together to give users compelling and coherent interactive story experiences.

Tangible Interfaces

When developing a story for a new delivery channel, it is important to consider both the form and environment in which it will be conveyed to its audience. As human beings, we have developed sophisticated skills for sensing and manipulating our physical environment, most of which are not employed by traditional GUIs (graphical user interfaces). When we interact with a keyboard or mouse, we focus on the screen and the scale of the screen, often losing sight of the architecture or environment around us.

Tangible interfaces are rooted in our physical surroundings, employing objects, surfaces and spaces as embodiments of digital information. As such, they can afford natural physical interactions with digital stories. They can turn multimedia storytelling into a cooperative and social experience by allowing multiple users to interact with the same story, in the same space, and at the same time.

The idea of using tangible components to tell interactive stories is far from new. Physical objects and environments (props and sets) can play an important role in both improvisational theatre and oral storytelling. Within the digital domain, a number of systems have been developed that explore the use of tangible controls for interactive stories. Examples include the Triangles interface [3], the genieBottles project [4], and the TOONS project [5].

Multiple Viewpoints

In his book *Actual Minds, Possible Worlds*, Jerome Bruner writes: "Perhaps the greatest feat in the history of narrative art was the leap from the folktale to the psychological novel that places the engine of action in the characters rather than the plot." [1, p.37] Tzvetan Todorov makes a similar distinction between what he terms *apsychological* narratives (plot-centered) and *psychological* narratives (character-centered) [8].

Alternating between different character perspectives as a story unfolds is a common technique in literature and film. It allows readers or viewers to gain access to characters' thoughts and experiences, and to use them as a contextual

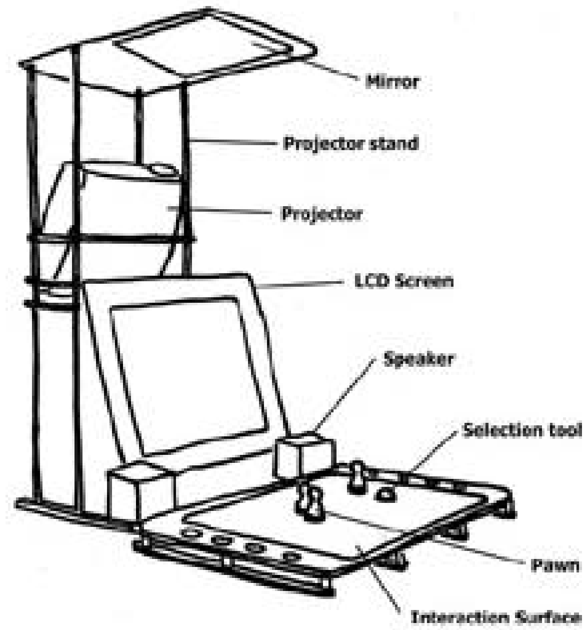

Figure 2. Diagram of the Tangible Viewpoints setup.

lens for understanding and interpreting the events in the story. In interactive storytelling, multiple character viewpoints can be used as a strategy for structuring user interactions into coherent story experiences. By allowing viewers to select the viewpoint, a single story space can turn into a myriad of story experiences, each one tailored to the preferences of a particular individual or audience. Moreover, the notion of multiple viewpoints reflects our increasingly global society that keeps us constantly aware of the many different cultures and perspectives on life. By reshaping the stories we live by and capturing these many different viewpoints, we can keep evolving and redefining how we think, play and understand our lives.

There have been a variety of interactive works based on multiple points-of-view. A few notable examples include the early videodisc-based piece entitled *A Different Train of Thought* [6], an interactive story modeled after Greek theatre entitled *Tired of Giving In* [7], and the evolving documentary *New Orleans: A City in Transition* [2].

SYSTEM OVERVIEW

The Tangible Viewpoints system uses wireless graspable pawns to navigate through a multiple viewpoint story. When a pawn is placed on the interaction surface, the story segments associated with its character's point-of-view are projected around it in the form of small images or text titles. A small lens-like object serves as a selection tool for viewing the story content. By gliding this selection tool over particular story segments, users can playback their associated story content on a nearby monitor, causing the narrative to advance and new segments to become available. The story content in Tangible Viewpoints can consist of various types of media (video, audio, images,

Figure 3. User interacting with *The Diner* story.

text), and as such can present character development, action and location with as much complexity as any scene of a film or chapter of a book. An aura is projected around each pawn to give a visual representation of the prominence of its character's viewpoint in the current telling of the story. Changes in the story space (i.e. when the story moves forward or there is a shift in character perspective) are reflected by dynamic changes in the projected graphics.

The narrative structure used in Tangible Viewpoints supports character-driven stories. As the story unfolds, the system gathers information about which characters a user has been interacting with, and makes decisions about what segments to present next based on this knowledge. If the user focuses their interest on a particular character, the system narrows the story's scope as it progresses, resulting in greater depth in that character's story. In contrast, a user who spreads their focus between all three characters will get a much broader story.

When two pawns are touched together on the interaction surface, the system displays only the portions of story that are relevant to both characters. In this way, users can examine relationships between the characters and see how their individual stories or perspectives relate to one another.

STORYTELLING WITH TANGIBLE VIEWPOINTS

The first story created for the Tangible Viewpoints system is entirely text-based. It is a short multiple viewpoint narrative piece entitled *The Diner*, which tells the story of three characters from different walks of life who meet at a diner in a small coastal town early one morning. Each character's experience of this encounter is different, shaped by their unique personality and perspective on life. By exploring the three viewpoints, users can gain access to the thoughts and feelings of the different characters, effectively seeing the story through each one's eyes. *The Diner* is a relatively conventional multiple viewpoint story created by a single author. Much like William Faulkner's short novel *As I Lay Dying* or Kurosawa's film *Rashomon*, it presents a set of carefully tailored character perspectives that fit into an overarching storyline.

The Diner served as a testing story during the design and implementation stages of the project. By having a set of story content ready at an early stage, we were able to pursue an iterative design process, gathering feedback from users in our laboratory, and progressively refining the interface and narrative engine during the development process. These early observations enabled us to confirm that the physical layout of the interaction surface and the system's ability to support the manipulation of multiple pawns at once make Tangible Viewpoints a good platform for collaborative story exploration.

Inspired by the collaborative nature of the interface, we decided to conduct a storytelling workshop at the Boston Museum of Science's Computer Clubhouse. The goal was to see how Tangible Viewpoints could be used to capture the differing narrative perspectives within a given community. Three participants were selected to collaboratively author personal stories for the system. All participants were teenage boys attending high school in Boston.

The workshop participants began by defining a structure for their story. They decided on a documentary style narrative that would chronicle one day in each of their lives in Boston. Their individual story threads would progress from morning through evening, and would overlap at times when the boys' activities coincided (for instance in the lunchroom at school, or at the Computer Clubhouse). Each participant used a digital camera to take still images over the course of one day. The images were then organized, edited as needed, and added to the story database. The participants also provided voice-overs for their images.

The Tangible Viewpoints system was set up in the Clubhouse environment for the entire duration of the workshop, and other members from the community were free to interact with the system and view the stories created by workshop participants at any time. In order to give viewers some content to interact with as soon as possible during the workshop, the stories were loaded into the system at an early stage in the production process. The stories were then progressively refined over time by editing the images, adding new ones, adding voice-overs, tweaking the meta-data, and re-ordering the clips. In this way, the storytelling process became a collaborative and iterative activity. By seeing their stories running in the system while they were still working on them, the boys could determine what changes needed to be made and could get suggestions from their friends during the production process.

Like the story creation process, the story viewing was mostly a collaborative activity. Clubhouse members would gather around the system in groups and interact with the stories together. They would frequently chat about the stories as they interacted, pointing things out to each other, and working together to explore the stories using the pawns and selection tool.

Figure 4. A group of boys interacting with the Tangible Viewpoints system at the Computer Clubhouse.

CONCLUSION

The Tangible Viewpoints project suggests a new direction for digital storytelling that incorporates multiple point-of-view stories with a tangible interface platform. The physical pawns act as handles on the character perspectives in an interactive narrative. Their movement on the interaction surface provides users with a direct mode of navigation to the story world.

The narrative piece created at the Computer Clubhouse gives a preliminary taste of the type of stories that can be told with the Tangible Viewpoints platform. Both the process of story creation and the final stories produced by workshop participants reflect many of the broad trends in contemporary interactive art. Adaptive, evolving and collaborative, these types of stories challenge the notion of a single "author" in the creation of artworks. Moreover, they shift viewers from their traditional role as passive story consumers into a role of collaborative story explorers. We believe that platforms like Tangible Viewpoints can help us capture the many different perspectives of contemporary life, allowing us to better understand society, our experiences, and ourselves.

ACKNOWLEDGMENTS

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How to win and loose beyond classifications? Collaborative agency in *the Game of Imaginary Beings*

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ABSTRACT

The Game of Imaginary Beings was an artistic outcome of the Cultural Usability -research project carried out at the Media Lab, University of Art and Design Helsinki, UIAH, during 2000 and 2001. The collaborative research focused on the questions of how the user is constructed in design of the interactive computer mediated environments and how the critical cross-disciplined theory and the design practice could be brought together. In this paper I am focusing on the question of how collaborative agency is constructed in *The Game of Imaginary Beings* as a work of interactive art. How the illusion of participation and agency, the role of the user as a designer, is created in the process of constructing an imaginary being and what kind of meanings the aesthetics of these interactive mirror-images suggest?

Keywords
art as collaborative process, interactivity, aesthetics, agency, surrealism

Mirroring "the other" of a designer

The Game of Imaginary Beings is an interactive installation. Originally it was an aesthetic study of following questions concerning designing and creating interactivity: Who are the designers imagining in the place of the user? Themselves or somebody else? How do they cope with what is different, with the “others” of design?

We, the group of four authors of the work, shared the opinion that some of these decisions are made subconsciously We suggested that the discourse of unconscious, the non-verbal, conflicted and embodied psyche, always effects on resulting design objects. Clearly, it also effects on resulting mode of interactivity. We decided to shed light on unconscious and the not so rational part of the design process. We also agreed, that for us, as a group of artists, researchers and designers, this "other" was the user who escapes classifications and taxonomies – the embodied, situated and conflicted subjects of different age, race and gender. Our aim was to picture the discourse of the "others" with the means of interactive aesthetics - and design an interface which would act like a playful mirror for the designer's "other" reflecting also subconscious processes of a designer's decision making.

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Remediating the work of a tailor

As a result, the purpose of *the Game* is to construct an imaginary being, a wish image, which escapes and surpasses rational everyday classifications by creating new and surprising meanings in the interactive process of choices. As an interactive game constructing a certain role for its player it also turns the immanence of the design process inside out and places the user in the position of the designer.

The player is given an illusion of being a tailor almost: she cuts, chooses and sews different objects together so as the final outcome, a Being, is constructed by her acts. Purposefully the interface of *the Game* also combines interface metaphors used in common designer's software for manipulating digital images: the player can drag and drop objects, use scissors for cutting out wanted pieces and compose her piece of design inside a working area. The Being becomes her own creation in a way.

The process of interactive construction in *the Game* is likewise similar to the acts of creating simple avatars in some on-line virtual communities. In many of these environments the participator can choose the head, the body, different body parts or accessories from a selection of symbolic objects for her on-line representation and sew them together in social action. She designs her own avatar and by directing it in the interactive environment gives it the agency. Is it her? the often contemplated question goes – or just a semi-automated cyborg reflecting her real self? Or the designers hidden "other"?

In *the Game,* as in the most of the so called avatar worlds, the process of creation is an illusion after all: The player creates the imaginary being step by step by making choices of pre-determined visual and textual objects and lets them be composed in "the mirror"-area of the interface. The composition and the possible threads of the choices as well as the hybrid meanings it arouses are carefully designed and programmed before hands and symbolically presented in the interface of the game. But without the acts of the player the meanings embedded in the objects would never exist and would never construct the creature either.

The Being constructed in *the Game* is not an avatar in the real sense of the the word, in the discourse of on-line communities neither, but is playing with the associations of post-human identities, constructed as chiasms of human and machine agency.

Making sense a'la exquisite corpse

The Game's aesthetic interpretation of the collaborative agency shared between human and machine factors is realised also on the plane of constructing and sharing meanings between human and machine agents in the process of interaction it makes possible.

In virtual worlds the tools for designing an avatar by the participator don't usually include the poetic comments added in the objects of choice. The participator is free to create her personal meanings implied in the object and the final combination of them and communicate and share these meanings with other avatars in the social environment. Nevertheless, in the moment she chooses the objects for constructing the character, she is already following culturally shared meanings, which the designers of the object database probably have followed too.

In *the Game* the player becomes aware of different stages of choices involved in the design process having to choose between objects with different ethical, political and cultural statements and between the meanings that doesn't really make sense. The fragment of a text inscribed to each object simulates cultural and personal meanings which might be implicated in certain design objects or the choices and combinations of them. The articulated meanings are expressed in manifesting, provoking, poetic, narrative or ambiguous style among others. Trough the aesthetics of interaction we also wanted to make visible such meanings which are normally shared in an interactive situation only unconsciously. In addition this aimed at showing how uncanny hybrid identities are constructed and made human-like. In order to reveal the subconscious discourse as well as the non-sense involved in a design process and the co-construction of meanings we studied collective forms of artistic processes: games of the early surrealists as well children's games of construction, where the aspect of chance and surprise were involved in.

Artists of the surrealist group are very well known for their approaches in deconstructing and revolting the status of an artist, the status of individual agency, by using chance, automatism, and mechanisms of games and collaborative processes in creating a work of art. The game of *Exquisite Corpse,* the familiar play of chance and subconscious associations, was one of the springboards for *The Game of Imaginary Beings*. The surrealist game is based on a mechanism of composing new surprising and hybrid meanings collectively, without a rational plan or contributors rational knowledge of what the other contributors were composing. In the interactive realisation of the *Game* this mechanism was remediated to a critical poetic reflective design practice in which the user was intimately engaged. This engagement might result in an experience of being an eyewitness in a situation where your right hand doesn't know what the left hand is doing. Consequently, I claim, that the collaborative agency of the designer, the user and the programmed machine agents are reflected and played out not only in the visual and textual imagery of *the Game* but mirrored even more thoroughly in the interactive aesthetics of it. With this I referring to the way that *the Game* turns the immanence of the design process inside out.

Becoming an imaginary being

The interactivity of *the Game* is based on the idea of winning and loosing beyond dichotomies of rational thinking and having to deal with objects arousing fragmentary, corporeal, poetic and uncanny meanings. By now. we have come to see how the players of *the Game* recognise something hidden of themselves in hybrid creatures called for example "A Melancholy Head-hunter of the Avatar Heaven", "A Telepathic Matriarch of Immersion" or "An Autopoietic Bachelor Mammal" - or of the other of them selves?

The interactive process following poetic as well as manifesting statements is also an ironic comment on making categorisations and taxonomies. In the end, the imaginary being will reflect the hidden desires of the designer of the being – the user of the game – and create new mythologies and fantastic zoologies of our collective subconscious.

Jorge Luis Borges describes the bestiary of fantastic imaginary beings of the past and modern times and mythologies, Golems, Chinese Dragons, Norns and Sphinxes, in his *Book of Imaginary Beings (1967). The Game of Imaginary Beings* constructs a miniature bestiary of post-human imagination in the process of interaction: it is not just an experience of going to a zoo of mythological hybrids, but becoming a one -- a hybrid being of collaborative agency.

GIGANT – an Interactive, Social, Physical and Mobile game

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ABSTRACT
The purpose of this project has been to design a mobile, interactive game where players physically move around in order to solve different assignments. Another essential goal was to create a game structure that didn't forced the player to act in pre-defined way; we wanted to draw a game that made it possible for free action choices and provide possibilities for the players to cooperate and develop strategies and interact face-to-face with each other.

Keywords
Ubiquitous gaming, play, computer-supported collaborative play, Interaction design, artwork.

INTRODUCTION
This project started when Electrohype, an organisation for artists working with digital art, asked us to develop a digital game to an art exhibition. The project was developed in cooperation with The Interactive Institute, Space and Virtuality Studio and The Interactive Institute, Game Studio.

OBJECTIVES
We wanted to develop a game with a game structure that made it possible for players to act freely and to cooperate, socially interact and develop strategies.

ARTISTIC WORKING METHOD
The design work in the Gigant project reminds of an artistic working method in many ways. We had a very small budget which resulted in extensive investigation for inexpensive materials – frequent visits to second hand markets for construction material, plastic and rubber fabrics (asking for leftovers) in search for material to test and work with. The collected material often gave us new ideas, changed the concept or directed us to what to search for next.

Especially in the beginning of the project the work was very similar to an artistic process – in that sense that is characterized as non-restricted and open, with an acceptance of any kind of ideas to be brought up.

We played forward scenarios and ideas, performance-like sessions, especially if we had an object, a material to reflect upon.

That in turn led to an expanded design space with many solutions and examples and it also resulted in a creative design environment.

COLLABORATIVE PROCESS
Our different backgrounds, as an artist and a social scientist, added different aspects in to the project and intensified our discussions. Our shared education in Interaction design and interest of games gave us a common ground to stand on.

Together we worked for a common understanding of how the game could be developed. This made it easier to work efficiently and unified in remaining periods of the project. This process started early in the process when we had a lot of brainstorming-sessions with discussions of our diverse opinion in different matters. During the project we evolved a mutual view of what were the right "Gigant qualities".

We didn't decide how the work should proceed or which methods we were going to use. The process evolved during the work. This didn't mean that we were without tools. We used our experience and knowledge from the disciplines of fine art, interaction design and social science. The character of the project invited us to be open towards different methods. The tools from these disciplines were used in a natural way. When a problem occurred or if we wanted to provoke a certain answer, we tried to use the method that was appropriate in the certain case.

THE SOCIAL LIFE OF ANTS
Quite early in the design process we decided to concentrate the game theme towards the ant life. We found the social life of ants very fascinating and started the game development by studying different ants species - how they interact with each other, what kind of functions different ants have and what behaviours they show. We discovered a lot of

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interesting interaction patterns that could use and transfom into game actions.

WORKING METHODS

We worked with this project during the summer of 2001 and the office was almost empty. We therefore took the opportunity to fully use the environment for our purposes. We changed the office to an atelier were and moved freely between different rooms and had our work material lying around almost everywhere.

One room had big white boards and we used the room as a brainstorming and investigation area. We listed everything that we learnt about ants on the white boards. Together we discussed what kind of ant behaviours and functions that could be transformed in to an overall game narrative and game actions.

In the lunchroom we worked in a more physical way with scenarios; made a few game boards illustrating game area with belonging game bricks (i.e. sugar cubes symbolise players), sketches and a mock-ups. With the intention of fully visualise and comprehend how different solution would affect the game story we physically moved around with mock-ups in our hands to really understand how the experience of interaction with objects or other players would be like. These methods also resulted new ideas and helped us to make cohesive decisions.

In the workshop we tested how to transform materials in to object that we wanted to create. We were melting, bending, sawing to see in what extend we could use the materials in creating prototypes.

We also worked in the sound studio were we tried to create organic sounds that we wanted to use in the game tools.

Appearance

Carbon mock-up couldn't tell us how the system would function and therefore we made a decision to have the digital prototypes ready rather early in the design process. In the prototype stage we put quite much effort in to construct objects that had a profile that was visually interesting. We made that decision for several reasons: We believed it would be easier to communicate about something that had an exiting form and could be touched and used. It could open up to discussion even thou the concept weren't in all details finished. Another reason was that we looked for sponsors to finance the last period of the project and it was therefore important to have something communicative to show. The third reason was that we wanted an opportunity to examine how it felt to use different digital game parts, for instant how to move around the playground with the ant attached and interact with other players ants, or how the ant ought to interact with the Aphid. I was essential to get a feeling of how the game play could be formed. So the objects, the digital prototypes were essential for us in order to get a feeling of the game experience. Fourthly, if we manage to create objects that could seduce and submerge the user into a play-atmosphere it could be a significant benefit.

THE GAME STORY

The game tools consist of five types of objects the anthill, ants, Aphides, pine needles and leaves. The main goal in the Gigant is to take care of the anthill by finding as much energy and construction materials as possible but also to protect the anthill from enemies. Two or more opposite teams are competing for the same resources and there is not enough material for two ant colonies to exist. The players have consequently to work hard to survive. They have to investigate a big area to search for materials and Aphides. The players have to find Aphides to collect energy and constructions material such as pine needles and leaves.

THE FREE-PLAY PAPER VERSION OF GIGANT

First we wanted to investigate if the game structure that we had sketched out perceived as to complex or to simple, fun or boring. In order to do so we arranged several game tests. In the game we used paper mock-ups mad of for instant boxes, carbon paper, that illustrated construction material – pine needles and leaves, drawings of Aphides and arranged several free play sessions. After every test session we discussed with the players how they had experienced the game play and asked for their advice and suggestion for changes.

When we had found a game structure that seemed to be engaging and fun we developed the digital version of Gigant. In discussion with Nabil Benhadj, the engineer working at Interactive Institute, we came to the solution of using infrared technology and microprocessors. Different game parts could then communicate with each other. The use of microprocessors in the game tools made it possible to chance their behaviour by reprogramming them. The game structure therefore became flexible and open for alterations. This meant that we could transform the game story, the rules and as well investigate which interaction patterns that perceived reasonable and understandable by the user.

THE DIGITAL VERSION OF GIGANT

Interaction patterns

One of our intensions was to make players interact with each other as well as with the game objects. We designed cooperative actions for instant helping a team member (i.e. share energy) as well as aggressive actions like spitting on enemy ants.

Aspects of interaction

We wanted to carefully examine and readjust the system feedback to make sure that the interaction patterns were easy to understand by the user.

The interface of the artefacts is very basic illustrated with sound, small lights, vibration. As a result of how the game parts are designed the focus is primarily in what happens between the players, like in ordinary free play. The Players experience and reaction of the game is a combination of the experience of the system feedback, the rules, and the organic like objects.

Electronic ant

With the ant attached on the forearm the player is able to examine different objects. The player will find out by pushing down the examine-button (placed on the ant's back) if the object is of good or bad quality, it responds by lighting a green (good) or a red (bad) lamp.

The player could choose to spit on another player if she wants to protect the anthill from an attack or herself from being spitted on. If the player chooses to attack another ant, she loses energy and the energy is needed in the anthill. Consequently she has to consider if an aggressive behaviour is to the benefit of the whole ant colony or not.

Symbiotic relation with Aphides

On the playground there are Aphides located on different places. When a player finds an Aphid she uses his electronic ant to make the Aphid start the energy producing process. The player places his ant under the Aphid tail and after a few second the electronic ant has gained full energy level.

Shared stomach

In some situations the players needs to collaborate. If someone has used all of his ants' energy, he has to find a team member and ask for help. Without energy the players' ant will be unusable. When the players share energy they put their ants' head in front of each other and the sender push the feed button down.

Pine needles and leaves

Big pine needles and leaves are to be found on different places on the playground. The player has to seek in a rather big area to find these objects. When he discovers one, he has to examine whether the object is infected or healthy. If the object is of good quality he carries it to his own anthill to gain points and if it is of a bad quality he should try to sneak it in to the opponents anthill and cause damage. The size of the objects makes it difficult to hide from the enemies, transporting an object means therefore a great risk being dis covered.

The Anthill

The anthill is a three-meter high and wide construction. Entering the dark anthill the player hears a sound that a change according to the anthills well being. Inside the anthill is an electronic ant mother. When a player delivers energy to the anthill he directs his ant, pine needle or leave towards the ant mothers mouth and the anthill will respond by a happy or a sad sound and a light respond.

OUTCOME – RESULTS

A reflection from demonstrations that we have conducted is that some people become extrovert, wild and playful when they attach the ant on the forearm. Could it be, that when attaching something on your own body it becomes personal and subsequently good or bad things that happen to your electronic ant affect the players' personal, emotional behaviour and experience?

The process

Based on the experience not only from the Gigant project we believe that the cooperation between art and science will probably be more rewarding if one would regard these two fields as being very fragmented and not attempt to force them into a preconceived form. We believe in that in the beginning of a cooperative project that includes representatives from both art and science one should try to avoid deciding which methods are the more useful ones. It has to be related individually to the circumstances of each situation. One could allow every situation or investigation to develop it's own mix of methods in relation to the work one is carrying out.

There is probably a lot to gain when one regard the cooperation between these fields as a learning process. Then one would focus on what is more interesting; the fact that you during a work in progress create something new; a new platform, a language and also create a space where artists and scientist can meet on equal terms and where new exiting events can occur. We could focus on creating this third space: that is not art nor is it science it is something else.

ACKNOWLEDGEMENTS

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“Spinning at Computers” or the Art of Conversation

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Keywords
Art as a collaborative process, aesthetics, interactivity

INTRODUCTION

As a part of the “Hamburger Datenkunstbewegung der 80er” (hamburgian data art movement of the eighties) we experimented in a playful way with computers and telecommunication systems to use them for human exchange. As a result we are now “Spinning at Computers”, what means, having a playful “to and fro” between people in tangible and associative ways. This is an artistic process, created by the involved persons, an art without spectators.

“Spinnen am Computer” (Spinning at Computers) is the name of a seminar at the Hochschule für bildende Künste in Hamburg, in which Prof. Antje Eske has been working for more than ten years to develop conversational Net.art. Conversational games or parlor games are based on the games played in the historical salons. Together with the art facilitator Tatjana Beer, she tested these games for use in intercultural communication in two Spinning seminars of the International Women´s University, ifu.

A playful “to and fro” as well as testing forms of social contact and expression means in our case using sound, color and short films or the possibility to express oneself by utilizing links, graphics and word processing. The conversational interchange happens via parlor games, IRC- or swiki-chat, et al.

A. ART AS A COLLABORATIVE PROCESS

Both, in the history of art and in contemporary art, collaborative processes are far more common than usually known, as well in strictly hierarchical groups as in loosely associated groups of individual artists.

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Especially for Net.art ”collaborative process” is a term that does not take effect and maybe covers up. The term as well implies production full of determination as an open, conversational-seeming co-production.

Net.art-typical conversation as a matter of fact is no co-production, because there is no work of art produced and presented to others. It is a flow of improvisation, because one never knows where its final destination is. It refers to the history of art, in this case the Salon Culture, and originates out of the exchange between people. One has to strife for no objective. A result only could be, collecting the “dregs of life”, a kind of moral humus, which is the basis of social change in a homeopathical way.

B. AESTHETICS

Conversation, which means mutual contact, is not included in the general idea of art. However there are references in the history with sufficient art-terms to legitimize this internet-typical art: e.g. Ars Sermonis, Baroque dance, Salon Culture, Costume (Masquerade), Romantic Sympoesie, Jam Session. Alsleben and Eske defined them detailed in the “NetzkunstWörterBuch” (ISBN 3-8311-2259-8)

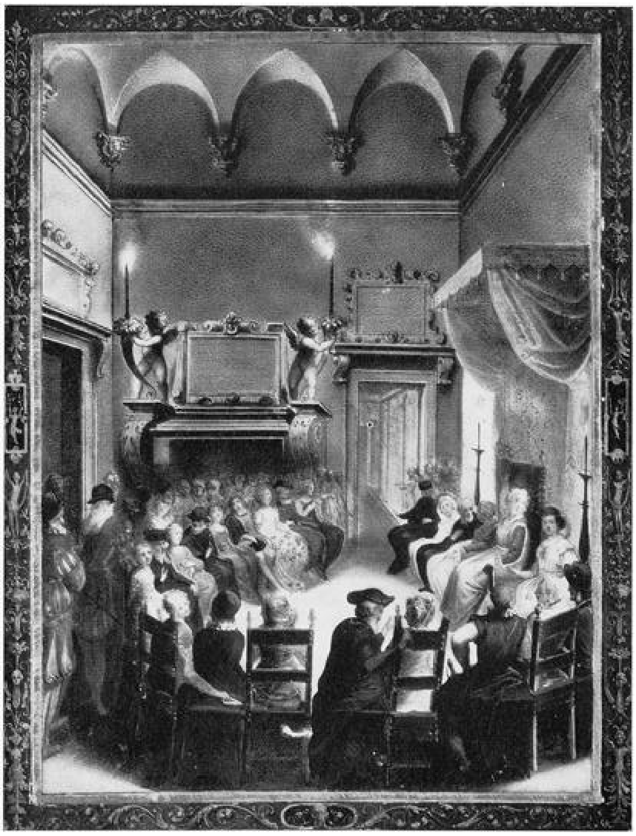
Conversational art runs diagonal to the kinds of art (e.g. music, literature) and the species of art (e.g. opera, sculpture), which always turn to an audience. Probably it constitutes a separate ”sphere of art” beside those kinds of art, which create products.

In June 1999 a conversational art-event took place, which connected the history of art with the Net.art. A group of artists (italian and german) initiated an Internet-chat. Brought into being by Kurd Alsleben and Antje Eske. This chat runs similar to a parlor game, described in the 16th century by Baldassare Castiglione in his book “Il cortegiano”.

We initiated the chat by laptop and mobile phone from just that place, where 500 years ago Elisabetta Gonzaga, Duchesse of Urbino/Italia, regularly met with a dynamic circle of women and men, to talk together, dance, play parlor games and engage into other activities.

We also connected ourselves with the conversational tradition by playing parlor games, which originate in the French salon culture of the 17th and 18th century. For in the French salon culture, with its roots in the Italian Renaissance, people sought new forms of connecting with each other and of committed human communication and intimacy.

Figure 1. The conversational circle of Elisabetta Gonzaga in the Sala delle Veglie, Urbino (1503-1508). Engraving: Fra Simone Ferri, 17th century



Net.art parlor games depend on the change of medium; here the associative leaps between word and image, in which sense or nonsense unfolds via vertical elevators from the unconscious (Surrealism). “Nonsense, as a particular variant of imagination ... creates space on the boundary of possible concepts ... [where one can meet and] which not only releases us from the usual strictures of ideas and conduct but also permits a distancing cheerfulness and a new appearance for people, objects and their constellations” (Dieter Baacke)

C. INTERACTIVITY

In connection with conversational Net.art it is necessary to make a difference between human/machine-communication and human/machine/human-communication, because only the last type of communication means conversation. The term ”Interactivity”, adapted by Cybernetics from Sociology, emphatically does not make this difference. That's why, as a mixed term, it is not helpful for the mutual art of human conversation.

An essential experience of conversation by parlor games, too, is to get the chance, changing the own perspective: One can look, together with others or alone, at the cards of a complete stack (done by the software HyperCard or HyperStudio, e.g.), in which several players have referred to each other by clicking on the keys that link the various responses. And so involved one can follow the wild leaps of ideas, calmly and for as long as it takes until the penny drops. Whoever has just grasped the message, automatically cries “Aha!” a sign that the change of perspective has just been accomplished and the players limits have been extended a little bit. He or she is able to become aware of the others “Otherbreadth” (Anderweite), what means to feel the breadth of the different possibilities of the other, which one can only experience in part.

Figure 2. Conversational circle in the Hyperspace (1999) during International Women´s University ifu. Photo-Collage: A. Eske, 1999

Following is a short description of seven net.art parlor games to illustrate a method of conversational exchange:

1. The first game is a version of *Silent Mail* (known in English as Chinese Whispers or Telephone) translated to HyperCard, in which a word or a short sentence is written by a player on the first “card” of a stack and, after a change of computer these writings are visualized on a second card by another player. At the next change the pictures are again interpreted in word form. Since the monitor always shows only the last card, the players soon loose track and the entire group becomes interlinked and connected.

2. The second game, *Metaphor*, is a round of introductions. The object here is to find out, which picture everybody wants to draw of oneself. Game rule is, trying to render a visual metaphor in several pictures. With a little programming these pictures can be turned into a movie.

3. The third game, *Visual Effects*, brings gestures, facial expressions or voice into the computer conversation quasi-metaphorically, since a link can be modified by means of visual effects in different speeds and image amalgamations.

4. and 5. The fourth game, *Jumping Jack*, and the fifth game, *Hyper Into*, are connected with responses. Unlike a letter, for example a card can be added directly at any place of the surface. This is done by laying a link in form of a button, which directly connects words, pictures or films to the response. “In Hypertext, the KEY (in German TASTE) can actually become a tactile surface between two statements, similar to the touch of skin on skin (making contact)” Volker Lettkemann.

6. The sixth game, *Les galères du bel esprit*, refers directly to the French salonière Anne-Louise du Maine (1676-1753), who played a similar game with her conversational circle in the Salon d´Aurore. Each player draws a lot with four rhyme words, in this case from a tin box instead of the original lady´s cloth pouch. The words are intended for use in composing poems, which changed during the next step in a visual form like a picture, a small film, an effective transition, etc. Our experiences with this game show, that the change of medium between word and image touches deep layers because something forgotten from the unconscious sometimes was brought to light.

7. The seventh game is a chat. Either *a poetic or a picture chat*. In those cases, where Net conditions do not provide for chats in words and images, poetic chats (haikai renga, limerick, etc.) permit us to make associative leaps even without pictures. In order to multiply the associations, word links that transports a background of meaning, sentimental metaphors, and nonsense words are tossed into the exchange.

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WORKSHOPS

THE PEA PROJECT – DESIGN STIMULUS

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ABSTRACT

Can a simple green legume, an ordinary garden pea, open up the field of design?
Can the humble pea help us to escape from 'defined methods' into another realm?
Can we discover in the palm of our own hands something about ourselves and in turn change the way we see the world around us?

Keywords

Reflective practice, creative thinking, phenomenological awareness, innovative teaching and learning practices, participative design studies.

WHAT IS THE PEA PROJECT?

The authors have successfully conducted the Pea Project with undergraduate industrial design students to stimulate creative thinking and reflective practice [1].

The Pea Project involves the adaptation of a series of successful and innovative teaching and learning practices that have had a significant, sometimes profound, effect on students. What begins with a rather bizarre - some might say eccentric - encounter with a pea develops into a deeply reflective experience.

The Pea Project consists of a number of complementary elements over the course of the conference. In our experience these elements generate participative elaboration and discussion of the themes that emerge.

The Pea Project directs the nascent designer to become self aware, to look at the overlooked and to connect with their surroundings [2].

It is our experience that this encourages designers to think more holistically and to engage in the practice of design at a deeper level. Furthermore it generates a deep sense of belonging to shared spaces and experiences, an essential characteristic for collaborative dynamics to be sustainable.

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THE PEA PROJECT PRECEDES DESIGN PRACTICE

Operating from constructivist [3] and phenomenological [4] perspectives, the Pea Project combines the banal and the everyday, with outcomes that are fundamental to the practice of design.

These outcomes relate to the development in the student of unforced awareness and a capacity for deeply reflective thought [1, 5, 6].

This workshop includes the creation, assembly and exhibition of photographic data captured during the conference; phenomenological encounters with, and responses to, this photographic *data*; and *responses to the responses*, emulating the layering and meta awareness of reflective entries in a journal.

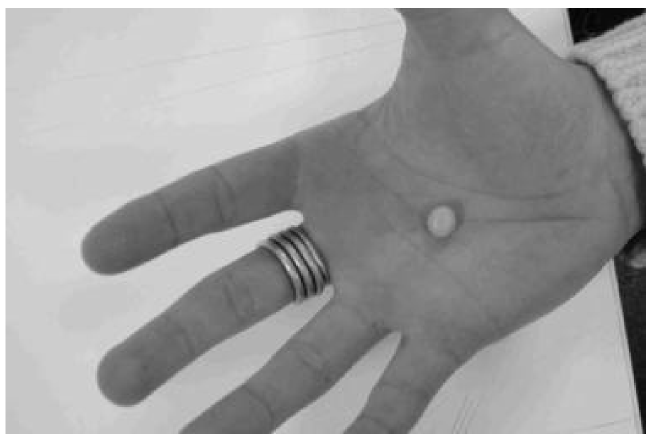

Figure 1 - Hand and Pea, 2001
Industrial Design, RMIT University

The Pea Project subtly and persistently demands that we venture beyond what we already know and understand, opening up and creating space for deep learning. This kind of thinking builds on the work of a broad range of educational theorists [7, 8, 9, 10, 11, 12, 13].

It is anticipated that our conference workshop will generate participative elaboration and discussion of the pedagogical themes.

THE PEA PROJECT – SUMMARY DESCRIPTION

Conference participants will be asked to take part in a reflective learning exercise. Each person will be approached during conference breaks and similar situations and asked to hold a pea while we take a digital photograph.

The Pea Project will *operate* over each of the three days of the conference, requiring one formal session on the second day;

- **day one** photographs and data collection;
- **day two** 60-90 minute experiential workshop;
- **day three** display of images and postcard responses.

We propose to experientially share with participants our innovative methods for stimulating phenomenological awareness, initiating and deepening reflective practices [5, 6, 14). We regard awareness and reflectiveness as foundational traits in developing and preparing designers for design practice.

At another level, we consider the process and outcomes of the Pea Project to be contemporary art – a work where the project participants become co-creators. France Morin [15] suggests "that artists have the capacity to make a lasting positive impact on peoples lives by helping them to see for themselves the dignity, beauty, and sacredness of the activities of their everyday life: the creative spirit, a powerful agent of transformation, that lies within everyone." The Pea Project aims to evoke this *creative spirit* in each and every participant.

Figure 2 - Hand and Pea, 2001
Industrial Design, RMIT University

In keeping with Bachelard's [4] view that "the communicability of an unusual image is a fact of great ontological significance", the image of the participant's own hand holding a pea becomes the focus of attention.

Each participant will receive a postcard of a previously photographed hand (figure 2). On the back of the card will be two questions, *What did you see?* and *What is going on here?*, with space for participants to respond.

As everyone starts from an equally obscure and ambiguous place, outside the "rubber stamps of conventional clichés" [16], responses tend to reflect the unique qualities, interests and experiences of the respondents.

The photographs and the completed cards will be presented and discussed at the subsequent workshop on the second day. The first part of the workshop will be presented in darkness, with a projection of the many hands and peas. Each hand and pea will be the focus of attention for a few seconds. This will be followed by a quicker projection of the images to promote a sense of the hands as a collective and to establish a sense of diversity and difference. Some participants are expected to experience a sense of reverie; others may see their hand as if for the first time or become aware of the shape of their own perception [17].

At the end of the PowerPoint presentation, with the lights back on, participants will be asked to reflect on the process, of which they have been part, and to again respond to the two simple questions *What did you see?* and *What is going on here?*. The combination of the quiet, darkened room and the call for reflection is anticipated to create a deeply thoughtful personal space.

This approach should create the conditions necessary for sharing experiences and personal responses to the combination of the hand, the pea and also the approach adopted. It is these responses that become the focus of discussion in the workshop. In a teaching and learning setting participants experience a range of responses that are as diverse as the hands depicted.

The combination of pea and hand, in particular the personal experience of being engaged in the process, stimulates multiple points of departure with shifts in figure-ground relationships and the emergence of personal projections. The material thus generated and recorded can act as a further stimulus to deeply self-reflective loops of engagement. Personal responses to the pea and hand encounter are expected to persist beyond the boundaries of the conference, opening up "zones of possibility for intellect and imagination." [18]

When the images and responses are displayed as a *collection* it becomes possible to see a diversity of ideas as well as common themes and overlaps in ways of seeing. The responses of others may also set off a further round of reflective engagement.

If the *quality* of images captured is consistent with previous efforts the collection of hands will be aesthetically pleasing - the images, particularly when projected, will be visually arresting and quite mesmerizing. Valerie Cassell [19], curator and director of the visiting Artists Program at the School of the Art Institute Chicago believes "that contemporary art has the potential to play an integral role in society by opening up spaces in which individuals may reexamine their own lives and their relationship to the world." For this reason, space permitting, we propose to continuously project the images captured in a preset sequence, in an automated PowerPoint presentation in a darkened room at the conference venue. Those attendees who have not been part of other aspects of the Pea Project will at least have some sense of the initial presentation.

Following the workshop the photographs and completed cards will be displayed for the conference participants to view, read and reflect upon. A second postcard will be available to allow participants to respond to the collection. These cards will be displayed alongside the original images, creating a dynamic and reflective forum. The Pea Project is endlessly extensible with many potential points of departure. We are sure others will adapt the idea of using digital images, postcards and simple everyday objects in ways we can barely imagine.

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We thank our 2001first year Industrial Design students.

AUTHORS' BACKGROUNDS

The three authors are members of *project-mu*, an interdisciplinary research team housed at the Interactive Information Institute at RMIT University, Australia.

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Barch Hons - Politecnico di Milano; PhD RMIT (current)

Lecturer and coordinator of Design Studies in the Industrial Design department, RMIT University, Australia. Main interests/skills include: Socio-technical issues related to Design (including studies on synaesthesia, semiotics, and usability); user-centred design (in particular applied to the design of Information Technologies); constructivist learning and teaching approaches; design of Product-Service Systems; design of collaborative work environments (includeing virtual work spaces); Multi-disciplinary research methodologies and dynamics.

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Over 20 years work experience in management and project management roles for Australia Post. Currently provides consultant and research services to a number of organizations including the Australian Army, Australia Post and Deakin University. Research focus relates to the use of art, images and visual media in management education. Key interests include: the practice of management, the study of everyday practices; organizational culture; anthropology; ethnography; art; visual media; art history/theory; political theory; spreadsheet modeling; teaching and learning; philosophy.

Michael Coburn

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Experience in building e-commerce solutions using a range of software technologies. In particular build-ing sites with streaming and interactive content. Familiar with AI methodologies including, but not limited to, agent based systems. This can manifest itself as agent-based personalisation for web pages. Experience in conducting requirements analysis and producing software specifications for software projects of varying levels of complexity. Research interests include: self-organising, self-assembling, self-similar entities, including nano-structures both in the physical and abstract domains; Human Factors, and how this discipline can inform industrial and user interface design.

Participatory Design of Information/Communications Infrastructures

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ABSTRACT
This describes a two-part workshop on the participatory design of information/communications infrastructures. Participants are invited to share and reflect on their participatory design experiences in light of recurring issues of infrastructure development.

WORKSHOP THEMES

Public participation in the development of information/communications infrastructures is both necessary and extraordinarily challenging.

Information/communications infrastructures come in many forms. The concept is broad, encompassing community networks, national ID schemes, privacy regulations, broadband networks, accessibility policies, classification schemes, network protocols, public kiosks, as well as many other services and facilities we tend to take for granted once developed. The unifying idea is that infrastructures should be widely available and useful for a variety of public interest purposes. To work well they need to be readily at hand to fit a wide range of everyday tasks, yet be largely out of sight and mind when not needed so they don't get in the way. The desiderata for good infrastructures pose contradictory implications for design. On the one hand, for them to fit well with the way people live they need to be adapted through many iterations of trial and refinement by their users. Also, since they are needed for everyday life, people have a vital stake in their development and hence a right to be heard in their design. On the other hand, the inherent features of infrastructure pose severe challenges to effective participation of their users (and citizens generally) in their creation and maintenance. Information/communications infrastructures typically are large, distributed, expensive and complex. In their crucial formative stages, those few with a strong financial interest enjoy disproportionate influence in their development. Once infrastructures are established, their desired invisibility then discourages careful attention to refinement and maintenance, until the breakdowns become widespread and seemingly intractable. Their inherent unwieldiness discourages the long-term engagement necessary to accomplish significant improvements. Many people have a stake but in differing ways, so consensus is hard to achieve, particularly when participation is broadly based.

But this paints too bleak a picture. It is important to observe that some very good infrastructures have been developed, reflecting the artfully integrated diverse contributions of many people. How has this been achieved? Each particular infrastructure development offers its own set of opportunities and constraints that may be exploited. How can we learn to read these situations and find effective ways to engage with others in developing infrastructures that work well for as many people as possible, and that can evolve as needs shift? These are the central questions this workshop explores.

GOALS

The main purpose of this workshop is to enable people who are actively concerned with some form of information/communications infrastructure development to get to know each other better and learn from each other's experiences. This will be done through the first-hand reporting of personal experiences in attempts at developing infrastructure and collective writing of a synthesis report.

METHOD

Discussions will be based on a report from the first part of the workshop, conducted at the Directions in Advanced Computing (DIAC) conference (Seattle, May 17, 2002) and on presentation of short position statements submitted in advance. On-site participants, to a maximum workshop size of 15, will also be invited to contribute their experiences.

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Creating, Sharing and Using Collections of PD Procedures

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GOALS & OBJECTIVES

The workshop is meant to serve for exchange about ideas for and experiences with collections of PD procedures.

Topics include the selection of relevant procedures, possible distribution channels and the interactive use and enhancement.

It is intended to use the results of the workshop as a basis for the design of a web-based interactive collection of PD procedures. We invite interested practitioners and researchers to participate in this process.

Issues and questions that could be addressed in the workshop are:

- Which procedures should be included into the collection? How can the range and scope of procedures be defined?
- What are the target groups of people potentially availing the procedures for themselves? How can the target groups be defined?
- How should the procedures be accessible? Which channels are suited and should be provided?
- How can the channel be designed so that it allows for a dynamic and interactive use and a process of continued discussion and improvement of the collection?
- What is it like to use collections of PD procedures? What are the experiences participants have in using collections of PD procedures?
- How can collections of PD procedures inspire or guide real-life PD processes?
- How can the procedures that are used in the process be selected from the collection?
- How can the actual experiences with the procedures be fed back into the collection?

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TARGET GROUPS OF THE WORKSHOP

We would like to bring together

- potential and actual users / consumers of collections of PD procedures,
- potential and actual designers of collections of PD procedures and
- potential and actual designers of publication channels for collections of PD procedures.

WORKSHOP ORGANISERS

Bettina Törpel
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Steffen Budweg
had worked as web application developer and online strategist. Currently he finishes his degree in Communication and Media Sciences and has worked as a research assistant at the Fraunhofer Institute for Applied Information Technology (former German National Research Center for Information Technology).

The Website of this workshop is:
http://orgwis.gmd.de/~budweg/ws-pdc2002

Working on sorting things in—and out: real-world complexity meets computer formalisms

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Information systems development makes use of a variety of methodologies for understanding work practices. Each of the methodologies emphasizes a particular set of work characteristics and thus results in one particular representation of the work. Many of the methodologies result in representations that make design easier, emphasizing formalizations and selection of aspects relevant to information systems developers. Members of the participatory design community claim that developers need to work with users in order to develop a rich picture of their work practices, and to preserve the many interests users may have in the information system. Systems development therefore should aim to design a variety of representations of work. Handling a multitude of interests may not make design easier or more straightforward, but the resulting information system will be better and better fit the work.

In this workshop we want to discuss the work that systems developers do in order to understand users' work practices. We want to discuss systems analysis as work on the relation between the rich complexity of somebody's work and the simplified, formal, machine-oriented specifications of a computer system (which results from systems development analysis). Engineering-oriented methodologies handle this contradiction by reducing complexity through formalizations and simplifications; by applying a particular perspective through the use of specialised languages and methods. Participatory design preserves the complexity and uncertainty until the problem-definition has been made? by users and developers together. The solution of the defined problem is then subject to the necessary simplifications and formalizations. (And what happens to participation in these phases?). When we carry out an analysis we choose what to emphasize? and not to emphasize; we can only represent some aspects of the world. In systems development the selection and representation of a set of characteristics of the world is done in the context of computer design, based on what computers can do. Analysis thus means abstracting, quantifying, classifying, standardising, building hierarchies, and simplifying into formal representations that? in the end? can be executed by a computing machine. We want to discuss where formalisms and real world complexity meet? can we find better ways of handling the contradictions between these different "logics"?

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In the workshop we want to pay special attention to contributions to this discussion from feminist researchers, offering a critical approach towards existing foundations of technology; methodological and conceptual issues, from feminist perspectives. Feminist researchers especially contributed to understanding the mutually dependent processes of shaping technology and politics (including gender). In the workshop we want to emphasise how information technology, politics and gender construct and are constructed in negotiations about borders and content, about metaphors and categories, about what is represented and not. The workshop is an activity within the Nordic-Baltic research network on "Information technology, transnational democracy and gender (ITTDG)"

FORMAT

Introductions by the organizer and some invited participants will open the workshop discussion:

Christina Mörtberg, Inst. of Gender and Technology, Univ. of Luleå, Sweden (dir. of ITTDG)

Joan Greenbaum, City Univ. of New York

Judith Gregory, Department of Informatics, Univ. of Oslo

Pirjo Elovaara, Blekinge Institute of Technology, Technoscience Studies

The workshop will include discussions and exchange of experiences with design or representations. Some examples of designs will be used to make the discussions more concrete. Workshop participants should be familiar with design and/or feminist critiques of technology and science.

Training the Bull *in* the China Shop – or *Outside*? New Student Exercises for Participatory Design

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WORKSHOP AIM

Organising collaboration is an important part of the participatory design competence. Most university programmes that teach participatory design rely on student design projects to establish this skill. Students try out methods by studying people at work in the local community and by involving them in design activities. But isn't this trying to train the bull in the china shop? Are there ways of providing students with hands-on experience in safe environments before they go out and try out their new social skills with 'real' people?

The aim of this workshop is to create an opportunity for teachers of participatory design to get peer review of design didactic issues concerning participatory design: How does one teach how to create collaborative participatory design sessions? Based on hands-on experience with selected student exercises we will seek to establish criteria for a repertoire of suitable exercises.

AUDIENCE

This workshop is targeted at experienced teachers of participatory design.

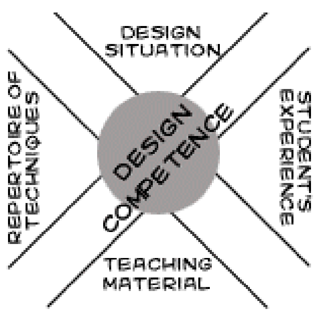

Fig 1. Design competence develops in the tension between design situation and teaching material, repertoire of techniques and student's experience

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INQUIRING INTO DESIGN EDUCATION

The workshop is designed as an inquiry into the practice of teaching participatory design. How can we make sure that students have reached an appropriate level of participatory design competence before exposed to the challenge of real life design projects? Designers practicing participatory design are often 'lonely cowboys' in their organisations. This puts high demands on their abilities to organise and facilitate collaboration. According to our experience learning by doing through projects with users may not be the best way to gain first time experience of practice. And to establish a reflective practice [Schön 1987] requires repetitive training.

As a starting point for this inquiry into participatory design didactics we will propose a simple model of design competence development. It takes the competence to sit at the crossroads of repertoire, experience, teaching material and situation sensitivity, Fig. 1.

We take 'repertoire' as a set of techniques for interacting with materials and users/clients. 'Experience' is the design apprentice's learning through hands on activity - in Dewey's term 'undergoing of consequences' of some trying [Dewey 1966]. Teaching material is cases, textbook material, site visits, video clips and materials from user sites. 'Situation' is a concrete instance in a given design project of people, time, space etc. Design competence arises from the actual blend of these four.

SINK OR SWIM PROJECTS?

The following three stories may give an idea of the kind of problems that motivates a peer discussion of design didactics. They describe problem situations we have ourselves encountered and which we think should be addressed in some way through teaching prior to actual participatory design project work:'

(1) Two students Ann and Sue conduct a future workshop with middle-aged blue-collar workers. Despite careful preparation and well-motivated users, they find that the users hardly talk to them - being young academic women - but rather to an engineer who also happens to be there. Is it

impossible for young women to organize user workshops in male dominated communities? How should they organize user communication?

(2) A graduate student Bob experiments with photography as a means for data collection and work practice analysis. However, in his final workshop, where workers are exposed to his photo material, he finds that they hardly make use of his photos: "*They just talked about other work situations without paying attention to the pictures I presented*". Bob concludes that the method is weak due to the workers lack of ability to reflect on their action. Is he right?

(3) Three students start a project on designing a heating control panel. The university has established contact with a local manufacturer, but upon visiting the company, the students get frustrated to find out that there are quite different opinions on what the goal of the project is: The company wants them to usability test one of their concepts, the professor encourages them to do user studies and scenarios, and they themselves mostly want to invent cool stuff. Who is right? And who has the responsibility to negotiate?

Apart from the pedagogical problem in student's finding out about collaboration problems the 'hard way', there is also the ethical problem of involving companies and users in activities that are likely to go wrong because the students haven't yet acquired the social capability of organizing collaboration.

DESIGN EXERCISES BETWEEN LECTURES AND PROJECTS

The authors have experimented with student exercises in the void between lectures and real life design projects. Our attempts to nourish design competence in a 'safe' environment have brought up a number of interesting approaches to design training:

Game playing – Students get the chance to establish a design process vocabulary in a game frame. Further more brick games serve as a test-bed for experimenting with approaches to collaborative design [Harbraken 1987; Binder et.al. 1999].

Interpreting images – Students learn to reflect on traits of a situation by means of picture or video documentary. Pictures and video act as open resources for students' learning [Buur et.al. 2000].

Facilitation training – Students organise internal workshops with researchers and fellow students to get hands-on experience with the challenges of facilitating a collaborative practice.

Appreciative inquiry – Students learn appreciative inquiry techniques as a way of communicating during the design process putting focus on the possibilities of the situation rather than constraints [Cooperrider and Srivasta 1987; Hammond 1996].

DISCUSSION BASED ON HANDS-ON EXPERIENCE

We plan the workshop to be highly interactive organized around what we take as key elements in the repertoire of designers occupied with participatory design. Participants are invited to share experiences from their own teaching practice and suggest successful examples of student exercises.

To provide grounding for the discussion we encourage participants to try their hands on some of the exercises during the workshop.

WORKSHOP PROGRAM

Introduction: The organizers introduce the theme and participants present themselves

Silent Game: Through brick games in small groups we focus our attention on the collaborative aspects of design and discuss a concrete student exercise example.

Wall of exercises: Participants briefly describe examples of teaching activities from their own practice and decorate a wall with exercises.

Trying out: In groups participants select 1-2 student exercises, try them out and discuss their merits. The organizers will introduce a simple evaluation form to focus the discussion on the value of the exercises in terms of participatory design competence and design didactics.

Wrap-up discussion: Towards the end of the workshop the groups present their observations for general discussion. We make an attempt to formulate criteria for good student exercises in participatory design.

ORGANISERS

Ole Iversen is a Ph.D candidate at Department of Computer Science. His research embodies design educational issues as well as attempts to expand the field of participatory design into designing with children.

Jacob Buur is a mechatronic engineer. He is professor of User Centred Design and manager of the Danfoss UCD group. His research includes product development processes and interaction design in industrial environments.

Ellen Christiansen is associate professor teaching Human-Computer Interaction. Currently her research is carried out at the Center for New Ways of Working, http://www.nwow.alexandra.dk/, targeting empirical and theoretical inquiries into knowledge-based systems in flexible work settings.

Arne Kjær combined a computer science background with cultural sociology. He is associate professor at Information Studies and head of the study program committee. His research includes design and learning issues.

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Interactive Spatial Design - Using Images to Communicate Qualities

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WORKSHOP QUESTIONS AND INTENDED PARTICIPANTS

Intended participants are researchers and practitioners interested in the problems of how to set up multi competence collaborative design environment within the architectural domain. How can you establish a common ground for dialogue and provide tools, which can help describe the qualities that you want to achieve? How can new digital tools be facilitated in these design environments?

Maximum number of participants = 16

BACKGROUND

The process of designing new modern workplaces is more challenging than ever, and new ways of working are needed in order to overcome these challenges. The challenges are rooted in the fact that today's companies have to operate in societies in rapid and continuous change where the introduction of new, better and faster technologies together with the increasing international competition calls for business concepts, employees and workplaces that fast can react on these changes. As technology becomes an increasing part of the activities carried out at work innovative workplace design is no longer just a question of architecture in the sense of spatial arrangement and furniture. Instead of a linear and successive design process we argue for a collaborative process that simultaneously take into account the physical space, the furniture, the technological support and the activities that are going to take place within the workplace. Such a design process is difficult to carry out, as it requires that people who have competencies within various fields work together on the same design task.

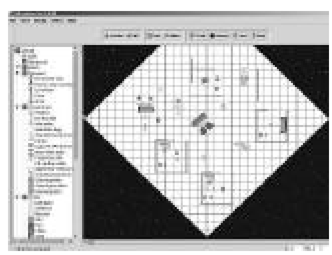
COMMUNICATE QUALITIES WITH IMAGES

There are a number of problematic aspects regarding design processes with collaborative elements. In workplace design, the planning process involves many actors from different parts of an organisation with a variety of perspectives, experiences and knowledge. A commission dealing with spatial changes is often initially vague. Unclear notions easily allow themselves to be caught up in the verbal language, while a physical design demands firmer representation. From this perspective, you can regard the process of designing as a transition from a diffuse sphere of concepts towards a sphere of concepts of more concrete character. An abrupt transition from the verbal formulations of those commissioning to the architect's graphic representations may hinder or be the reason why the participants are not able to develop their own comprehensible images and visions. In order to compensate for this shortage, as a complement to the spoken language, Saddek Rehal has proposed that one uses images or pictures to discuss aspects or phenomena considered to be important for the design situation in question. In this manner, the dialogue is able to enhance the notions of those participating, provide a richer content for the commission and a good point of departure for a stimulating dialogue with the architect.

INTERACTIVE DESIGN TOOL

Peter Fröst is a member of a research group that has developed a working prototype for an interactive design tool, to be used in collaborative architectural design processes.

Fig 1. FSD "game board"



The prototype is an extremely "easy to use" digital modelling tool, called "ForeSite Designer" (FSD). FSD enables the users to build spatial worlds of prefabricated components on a building site in 2D on the computer

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screen. With a single mouse click FSD exports the 2D layout to a lit-up 3D/Virtual Reality world in the computer game "Half-Life." The idea is to work with 2D images that one can freely choose, combine, copy and arrange in many different ways. In this way you are invited to collaboratively work together with building an environment. The images can represent a wide variety of different elements according to the possibilities in a modern computer game. It can be physical building elements as walls, windows, furniture etc but also entities as images, sound, animated textures, text, persons with pre-programmed behaviour etc.

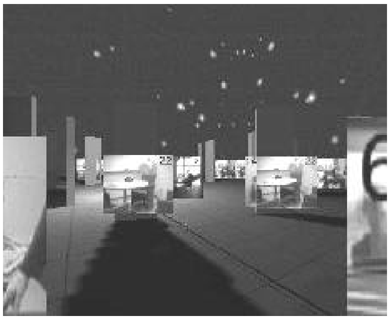

Figure 2. Walking around among images

FSD is developed and optimised for the use of unskilled persons who has limited time to learn and use the design tool. FSD is in accordance with this purposely made very simple to use, and it can provide untrained, non-professional participants with a tool for rapid interactive designing and evaluating ideas in collaborative settings.

GOAL AND OBJECTIVE OF THE WORKSHOP

The goal of the workshop is to design and build a virtual space connected to certain defined qualities. The use of images and their relation to spatial qualities will be investigated. The participants will be divided into cross groups, with the assignment to design a space for work where collaboration and creative work can be supported. That also means to present a story within a collectively predefined theme, and design a spatial solution for that story. The groups will try the ForeSite Designer interactive tool to visualize their ideas. They will be equipped with a set of images and simple building components. The virtual world building will be circulated within the group so that all participants can try "hands-on".

After this a presentation will be carried out on a large screen display. The persons who present will be placed in front of a large projection of the virtual spaces they just have modelled. They are then able to immediately interact with a Virtual Reality world in scale 1:1 of the image scenario they just have designed. They can navigate around freely in the world and show the rest of the participants all the arrangements and where they had placed and integrated images in their worlds. The last event in the workshop will be an evaluating discussion where everybody will be given the possibility to comment on what they had experienced during the workshop.

Figure 3. Presentation to the audience

Agenda

Duration	**Activity**
0,5 hour	Introduction, task definition
1,5 hour	Group discussions and "hands-on" building of virtual environments
0,5 hour	Large screen presentation of actually built solutions
0,5 hour	Evaluating discussion

ORGANISERS

Peter Fröst, Architect and Researcher: - In our research group at the Interactive Institute in Sweden, we have during the last year been working with the challenge to design design-processes in architecture that involves users and a manifold of different stakeholders in joint design commissions. Focusing on workplace design our goal is to develop a design process that integrates today's complex and fast changing conditions and the bouquet of multi disciplinary partners who are engaged in the work to shape the modern workplace. My own research is primarily focused on developing and integrating advanced visualization technology into these design environments by application of digital tools such as 3D modelling and Virtual Reality.

Saddek Rehal, Architect and Researcher, Innovative Design at Chalmers University of Technology. My research focuses on the communication between design actors from different part within a company organisation involved in workspace design. The goal is the development of a method and tool for communication between participants in the early stages of design processes. I propose the use of pictures in order to increase the possibility for the participants to reflect and articulate qualities that are difficult to describe with only common language.

Symmetry of Ignorance and Informed Participation

—

Analyzing the Synergy of Related, But Different Approaches to Participatory Design of three Research Centers

(Organizers)

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INTRODUCTION

The field of participatory design grew out of work beginning in the early 1970s in Norway, when computer professionals worked with members of unions to enable the workers to have more influence on the design and introduction of computer systems into the workplace.

Participatory Design (PD) is considered, understood, and practiced as a set of diverse ways of thinking, planning, and acting through which people make their work, technologies, and social institutions more responsive to human needs.

The wide-spread use of computers and the emergence of the Internet have opened new challenges for PD transcending the initial focus of *information system design* toward a broad range of digital technology including *web-based, mobile, ubiquitous and new media environments.*

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OBJECTIVES

The workshop will explore the further broadening of the concept of participatory design beyond information system and digital technology design to collaborative work and collaborative learning. This will be done by describing, discussing, and contrasting the work of three major research centers. These researchers centers

- *share some common basic beliefs and objectives* (e.g. with regards to participation, learning, and democracy),
- but they also have *their own identity and focus* (e.g. with regards to work, technology, and art).

The workshop will explore the synergy resulting from a comparison and integration of these different research perspectives and objectives.

METHODS FOR MAKING THE WORKSHOP INTERACTIVE WITH THE PARTICIPANTS

Our methods will include the following:

- articulate and define controversial issues by contrasting the three approaches;
- use of a discussant to further identify the controversial issues as a foundation for discussion;
- let the members of the audience associate themselves with a particular research direction and argue for its respective strengths and weaknesses; and
- create jointly a synergy of the different approaches.

RELEVANT BACKGROUND OF THE ORGANIZERS

School of Arts and Communication, Malmö University (Pelle Ehn)

In 1998, a number of researchers and teachers, several of whom with extensive research experience from and a long standing commitment to the idea of participatory design, came together to form a new school and studio based research center oriented towards the design of digital media and artifacts. Our vision for the new 'Digital Bauhaus' was instantiated at Beijerskajen 8 in Malmö in close cooperation between the School of Arts and Communication and the Interactive Institute. As the Bauhaus from the 1920s the vision was a program for the design of artifacts based on progressive social and cultural values, artifacts designed to engender social change. The Manifesto for this 'Digital Bauhaus' envisioned a critical and creative aesthetic-technical production orientation that unites modern information and communication technology with design, art, culture and society; and at the same time places the development of the new mediating technologies in their real everyday context of changes in lifestyle, work and leisure. The research studios at the institute and at the school have a focus on digital technologies in relation to space, narrative and creative environments, and art.

More information about the work in the research studios and at the school can be found at:

- about the vision: Ehn, P. "Manifesto for a Digital Bauhaus" in Digital Creativity, vol. 9 no. 4 , 1998.
- about the space and virtuality studio: http://space.interactiveinstitute.se
- about the narrativity and communication studio: http://narrativity.interactiveinstitute.se
- about the creative environments studio: http://www.creativeenvironments.mah.se
- about the shift program: http://www.skiften.com

Center for Activity Theory and Developmental Work Research, University of Helsinki (Yrjö Engeström, Jaakko Virkkunen)

The Center for Activity Theory and Developmental Work Research was established in 1994 to conduct research in work, technology and organizations going through transformations. The establishment of the Center was a turning point in the development of the methodology of developmental work research (DWR) that had been going on already for about ten years. The methodology is based on the cultural-historical activity theory (CHAT) that stresses the culturally mediated, historically evolving and layered nature of human activity as well as the related idea of expansive learning. The methodology relies on interventions aimed at helping practitioners analyze and redesign their activity systems. In these interventions the practitioners and the researchers identify with the help of empirical data (e.g. video excerpts) important recurring disturbances and ruptures in the collaborative activity, as well as local innovative deviations from the standard practice. Collaboratively they analyze and model the historical and systemic causes of the disturbances as inner contradictions of the system of joint activity using conceptual models of activity theory and expansive learning theory. On the basis of this analysis, an expansive solution to the contradictions is created and implemented experimentally so as to create a historically new form of the activity. The methodology was first applied to single activity systems. Recently, the developmental processes have increasingly dealt with networks of activity systems. The Change Laboratory is a new method for carrying out developmental work research in a condensed form. The methodology has been applied in various fields of activity such as schools, hospitals, service organizations and industry as well as in various kinds of transformations.

For more information about the Center and the approach see

- http://www.edu.helsinki.fi/activity/
- http://communication.ucsd.edu/MCA/Paper/Engestrom/expanding/toc.htm

Center for LifeLong Learning and Design (L^3D), CU-Boulder (Gerhard Fischer)

The Center for LifeLong Learning and Design (L^3D) has contributed over the last fifteen years to a co-evolutionary approach between (1) a new understanding of thinking, working, teaching, learning, and collaborating, (2) the development of new media, and (3) the change and evolution of institutions (schools, universities, and workplaces). We have developed a number of innovative technologies such as domain-oriented design environments, critiquing systems, and organizational memories.

Recent research efforts in L^3D have focused on social creativity and meta-design in lifelong learning communities. The approach is grounded in the belief that human creativity arises from activities that take place in a social context where interaction with other people and the artifacts that embody group knowledge are important contributors to the process. We have developed and evaluated new socio-technical environments, such as the Envisionment and Discovery Collaboratory and Living Organizational Memory that allow all stakeholders to engage in *informed participation*, exploit the symmetry of ignorance as a source for creating new knowledge, and attempt to create shared understanding among stakeholders with the incremental development of boundary objects.

More information the Center's work can be found at:

- about the Center itself: http://www.cs.colorado.edu/~l3d/
- about the Envisionment and Discovery Collaboratory: http://www.cs.colorado.edu/~l3d/systems/EDC/ and Fischer, G., E. Arias, H. Eden, A. Gorman, and E. Scharff (2000): "Transcending the Individual Human Mind — Creating Shared Understanding through Collaborative Design", ACM Transaction on Computer-Human Interaction (TOCHI) Vol. 7, No. 1, March 2000, pp. 84 -113. [http://www.cs.colorado.edu/~gerhard/papers/tochi2000.pdf]
- about the enTWIne research grant on "Social Creativity and Meta-Design in Lifelong Learning Communities": http://www.cs.colorado.edu/~l3d/entwine/ and Fischer, G. (2001): "External and shareable artifacts as opportunities for social creativity in communities of interest", in J. S. Gero and M. L. Maher (eds), Computational and Cognitive Models of Creative Design V, Key Centre of Design Computing and Cognition, University of Sydney, pp. 67-89. at [http://www.cs.colorado.edu/~gerhard/papers/ccmcd2001.pdf]

INTENDED PARTICIPANTS

We would like to attract participants with very different backgrounds in order to exploit the symmetry of ignorance and engage them in informed participation grounded in their respective background:

- researchers and practitioners;
- designers and people who study work processes and evaluate the usability / usefulness of new media and new technologies; and
- people who come from different countries representing different cultural values.

Visual construction

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ABSTRACT
The idea behind Visual Construction, VC, is derived from a use of visual material in participatory design. The use of VC is a natural development of the qualitative user-centred design tradition. We wish to address the potential of visual anthropology within the boundaries of participatory design. Furthermore it is necessary with an explanation of the potential of the 'picture' – hereby meaning the visual material we have worked with e.g. the photograph, stills, art and sketches. With a correct understanding and use of pictures, it can function as a building bridge between the designer and a user. The interpretation and use of different pictures facilitates a context-awareness that can help to minimize the gap between the user and the designer. The goal for VC is to extend the field of participatory design with a visual anthropological perspective and to introduce a use of the picture, that will extend cultural-awareness of the designer.

Keywords
Visual Anthropology, cultural visualization, qualitative interviewing, visualization in design, cultural awareness.

INTRODUCTION
The VC method is developed from the notion of the communicative potential in visual material – in our case, 2-dimensional pictures. When encountering a new context, it is necessary for the designer/researcher to get a grasp of the context/culture. The traditional way of conducting this is by the use of observation and several interviews.

By making the users/participants construct a presentation poster with the use of pictures, you create a form of narration, which provides the designer with a unique insight of a given context. The context is visualized by the users in the construction and discussion of the narration they construct with the means of the visual material.

There is a crucial point in the sense of construction. The necessity for control is almost absent. It is the inspiration and potential for interpretation, within the picture, that guides and controls the interview. In this way, it is the user who controls the fluctuation of the interview. The VC method provides a forum for a continuous discussion and reflec-tion, which is a result of the potential for interpretation provided by the visual material. The method of Visual Construction provides the means for a construction, rather than the re-constructing often found in the traditional verbal interview.

THE METHOD IN BASIS
On the basis of an initial interview the researcher/designer creates or chooses a certain amount of pictures from which the users are to construct a presentation poster – visualizing their company culture or a given thesis within the design paradigm. The final research information is the discussion and reflection on the visual material combined with the final presentation poster. When the construction is completed, the users are asked to give an explanation regarding the content and expression of the presentation poster – this provides an opportunity for the designer to ask elaborate questions.

OBJECTIVES
The objective of the workshop is to present the Visual Construction method, and give the participants an understanding of the constructive perspectives within the method. By explaining the potential of Visual Anthropology within the field of participatory design, we hope to get responds as to how the use of visual material e.g. pictures can broaden the possibilities for an extended cultural-awareness. The participants of the workshop, will be inspired to use a form of visual material in a design context. It is through the use of pictures, the participants will come to an understanding of how the use of certain pictures can guide an interview in certain directions, without intervening directly with the interview process. The workshop will introduce the semi-structured interview, which opens the

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narrative room – understood as the potential for a free narrative created by the users. Further-more the workshop is intended to initiate a discussion concerning a proper use of pictures in a given design-context. This might serve as an introduction to the field of Visual Anthropology. Visual Construction is still a method under development. The method demands a con-siderable amount of input, both practical and from a visual theoretical perspective. It is our hope that the workshop will help us in a further development of the method.

THEORETICAL BACKGROUND

It has been customary to apply ethnographic and anthropological qualitative research methods in the field of participatory design as a way of obtaining information about the user-context. With methodical inspiration from the field of Visual Anthropology and with the use of Peirce´s definition of the sign, VC is developed to be a strong supplement to the qualitative interview.

Visual anthropology

The field of Visual Anthropology is concentrated around a form of visual representation. Visual Anthropology is the studies of culture through an analysis of the production of visual material, pre-existing visual material and a corporative production of visual material – a cooperative of actors and the researchers [1]. The different methodical approaches to the field of Visual Anthropology all take outset in a concrete problem. During the workshop session we will present the participants/actors with a given problem and let the narration build around this given problem.

Instead of constructing a narration regarding a fictive culture or a fictive user-context we find it more appropriate to facilitate a narration in which the participants will reach an understanding of the method and the potential of the picture an interviewing tool.

Design images

In the understanding of a given culture the picture has communicative abilities, which support the users own sense of context and thereby mediation of this context. The picture in this relation functions as a semantic object, which is to create a relation between something new and something known and to ensure a meaning within relation. Meaning is to be understood as creating something recognizable – to create a relation to something already known and thereby useable. The picture then becomes something constructive, an artefact that brings new understandable information into the process of design. The picture is the medium that facilitates the on beforehand semi-structured interview, and at the same time facilitates an open discourse. The Percian understanding of a sign provides the researcher/designer with a tool to select the proper pictures. In the construction of the narration it is necessary to provide the users with pictures containing a given potential for interpretation. By controlling the interpretational potential, with the use of the different definitions of a sign, it is possible to structure an interview without intervening in the process of creating the narration. The method of visual construction thereby provides a basis for a constructive use of an understanding of the sign. With an intentional use of the symbolic, indexical, and iconic signs it becomes possible to semi-structure the interview. The use of symbolic signs may in addition open for a reflection among the users, reflections that may put a new perspective on the users cultural-awareness.

THE NARRATION

The Visual Construction method provides certain frames for the production and presentation of a narration. The workshop will provide a forum in which it is possible to create different narratives, depending on the particular problem. The participants will obtain an understanding of the construction of a narrative, and come to understand how the different narratives form a larger narrative, which eventually will form the final presentation. In the production phase, the participants will reflect and discuss several issues, which take outset in the interpretation of the pictures. These verbal discussions and reflections will provide the designer/researcher with an extended knowledge of the context. The construction of a narrative, through the use of pictures, puts a certain responsibility on the partici-pants – they have a responsibility in the construction of the narrative, a responsibility that usually is put upon the researcher. One negative aspect of the researcher guiding the interview is that of the closed categories. When entering a new user context the researcher has an agenda, which to a certain degree will control the interview. In the method of visual construction it is the respondent who guides the researcher – not the other way around. During the workshop it will be demonstrated how the given narrative will be constructed, not only through the verbal discourse but also in the spatial structures of the presentation poster. These spatial structures are an expression of the categorization, which takes place when constructing a narrative. The notion of categorization and classification is important to the understanding of how certain respondents classify and categorize their context [2]. Classification and categorization are important perspectives when analysing the narrative expressed verbally and visually.

WORKSHOP PROGRAM

Introduction: The organizers present themselves and the idea behind visual construction.

Method in action: The participants are divided into groups of equal numbers. During the execution of the workshop each participant will experience the workshop from both the interviewer and interviewed point of view. The workshop will take outset in a given design context.

Closing discussion: Each group presents their poster and the organizers will conduct a general discussion about the use of visual construction, within the field of participatory design.

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E-voting for citizenship in the information society: experiences, technologies, strategies

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Keywords

E-voting systems, citizenship, social choice.

INTRODUCTION

Recently, the interest for electronic voting has significantly increased: it is no longer a topic of interest for researchers and technologists only, but also media discuss, promote and criticize e-vote. In the framework of its Information Society Technology (IST) program, the European Commission has funded several projects which deal with electronic voting, mainly focusing on the technical and economical aspects. The aim of the workshop is to stimulate a multidisciplinary discussion about important socio-technical issues related to e-voting.

Experiments with e-voting and e-polling have already been carried in various places. On the WWW, we are frequently asked to answer to polls on the 'today's news' on the home pages of popular sites and portals. Also public institutions have done first experiments of using on-line polls to sense people's opinions about hot topics. The same could happens within large organizations such as the political parties, which nowadays suffer from lack of participation and need new forms of relationship with members and with the general public.

E-voting is not simply reproducing in an electronic way voting procedures as followed in political elections, from the city council to the European parliaments. The field of application is wider and includes referenda (which do exists in several European countries), consultative poling, and so on. E-voting may open new possibilities for renewing democracy. But is may as well irreversibly undermine the foundations of representative democracy based on universal suffrage. In comparison of the potential importance of e-voting might, citizens are hardly aware of its possibilities and risks. The same holds for politicians who seem far from realizing the potential impacts of e-voting.

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E-VOTING SYSTEMS

E-voting systems consist of several components:

1. a protocol to guarantee several crucial properties, including voters eligibility and authentication, vote uniqueness, secret voting without coercion, and the accuracy, integrity, verifiability and auditability of the voting process, etc. Are these properties at the same level of importance?
2. an user interface to create the best usability conditions for each segment of the population, including elderly and disabled people;
3. an organizational and institutional (and political?) setting which includes and supports the technological e-voting system.

Depending on the design and implementation choices of all these components, various positive and negative scenarios appear:

1. making possible in-house voting, e-vote might enhance voting participation by elderly and disabled people, but it might also have the opposite effect because of difficult and cumbersome user-interfaces;
2. e-vote can make calculation of the outcomes more reliable, transparent and free from (unintentional and deliberate) falsifications; but, it might also constraint voting freedom (in-house voting may allow a kind of control or pressure by family members or other people present during the voting;
3. e-vote may encourage young people participation,

but also reduce their awareness of the importance of participating to voting;

4. e-vote might enrich and reinforce representative democracy with elements of direct democracy, but it might also destroy both.

These kinds of dichotomies show that the discussion about the general social and political issues of e-voting should influence the design and implementation of the e-voting systems: citizens, citizens' representatives and politicians should be able to translate their opinions and remarks about the structure and functioning of the political system into socio-technical requirements for the design of components of e-voting systems. Otherwise, once more, a technology with possible crucial impact will be developed without the appropriate involvement of the civil society, and, when developed, it will impose its implicit norms on society.

AIM AND STRUCTURE OF THE WORKSHOP

The aim of the workshop is to stimulate a multidisciplinary discussion about important socio-technical issues related to e-voting. With a maximum of 15 participants, we aim at bringing further the theoretical understanding of the effects and possibilities of e-voting systems on political representation, and on citizenship.

We especially encourage submissions based on concrete experiences and projects. Also high quality theoretical position papers are welcomed. The format of the workshop is one of intensive discussion in order to produce an agenda for e-voting research and politics, from a participatory design perspective. The participants are requested to submit a (position) paper to the organizers, and these papers will be made available to the participants in order to be well prepared for the meeting.

THE ORGANIZERS

Fiorella De Cindio is Associate Professor of Programming Languages at the Computer and Information Science Department of the University of Milano. Her research interests include Petri nets as concurrency theory, object-oriented and distributed programming languages, and the applications of the ICTs to support life and work within social and office systems. In this field, she undertook action research and education on workers' participation in system design in the 1980s, and she was also a member of the team which conceived and developed one of the first CSCW prototypes: CHAOS, Commitment Handling Active Office System.

In 1994, she promoted the Civic Informatics Laboratory, for which she is now responsible, and, in this role, she set up the *Milano Community Network* (RCM), which is now a Participatory Foundation.

Peter van den Besselaar currently is head of the Social Sciences Department of NIWI, an information science institute of the Royal Netherlands Academy of Arts and Sciences, and Associate Professor of Social Informatics at the University of Amsterdam. He has published extensively on the social dynamics of scientific and technical change, on structures of information spaces, on technology and employment, on PD, on digital cities, and on e-government.

Currently he is involved in three major EU funded projects: *Commorg* (a comparative study on email use in organizations), *Eicstes* (a project studying and mapping the structure of the WWW) and with Fiorella De Cindio in *TruE-vote*, a project on electronic voting systems.

A Pattern Language for Living Communication: Deepening Participation

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ABSTRACT
This workshop is directly tied into an ambitious, global, strongly participatory project organized by the Public Sphere Project (PSP) of Computer Professionals for Social Responsibility. The intent is to build a coherent and compelling "pattern language for living communication" which reflects the collective wisdom of a very loosely knit community of activists, researchers, policy-makers, and technologists worldwide currently engaged in a wide range of technological and social activities to develop a communication and information infrastructure that supports social and environmental amelioration by civic society. The objectives of the workshop are as follows: move pattern language forward (refine patterns and/or language; make process more participatory), get participatory design community involved in a long-term way on project, evaluate and critique the project so far, surface ideas for deeper and more effective participation in process, and add new patterns (especially related to participatory design) and insert more participation within the patterns themselves.

Keywords
Pattern Language, participatory design, public sphere, knowledge structure

CONTEXT
This workshop proposal is directly tied into an ambitious, global, strongly participatory project organized by the Public Sphere Project (PSP) of Computer Professionals for Social Responsibility. The intent is to build a coherent and compelling "pattern language for living communication" which reflects the collective wisdom of a very loosely knit community of activists, researchers, policy-makers, and technologists worldwide currently engaged in a wide range of technological and social activities to develop a communication and information infrastructure that supports social and environmental amelioration by civic society. Thus the pattern language will ultimately contain theory, philosophy, political dimensions, design practices, as well as nitty-gritty, pragmatic suggestions. We plan to publish this pattern language in online and printed form. A "pattern language" (described below) is a somewhat complex theoretical structure which is based on the insights of professor emeritus Christopher Alexander and his colleagues at the Center for Environmental Design at the University of California, Berkeley. Alexander's book, *A Pattern Language* (1977) is a classic in the area of architectural design and theory.

This workshop is the next phase of a larger process. At the time of this writing approximately 165 pattern proposals have been entered (from people in Bolivia, Ghana, South Africa, Malaysia, Philippines, Argentina, Japan, Russia, Canada, western Europe and the United States) into our online "pattern management system" (http://diac.cpsr.org/cgi-bin/diac02/pattern.cgi/) and are therefore now available for public viewing and pattern submissions and for editing by authors. By the time of PDC in June, 2002 it is hoped (and believed) that the language itself will be further advanced. Although additional patterns will have been submitted, the more substantive work will have been completed on the language itself: merging, deleting, refining, ordering, and linking of patterns into a form that more closely resembles a *complete* pattern language that covers the entire domain (itself a difficult definitional problem) is non-duplicative and non-self-contradictory, and is coherent, compelling, and useful in a wide variety of situations. At this phase of the project I am hoping to engage the participatory design community in a participatory evaluation, critique, and brainstorming session. Since the project is intended to be participatory in a very broad way (from initial development to eventual use and evaluation) engaging the participatory design community in a dialogue as to the current state of the project and the possible avenues for its completion is seen as absolutely critical. The challenge here is setting the

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stage so that the workshop effectively meets its objectives. A major part of this is providing the right amount of project information in the right form at the onset and asking the right sorts of questions of the participants.

This proposal describes the basic parameters of the workshop but I will be relying on the expertise, knowledge, and independence of the attendees to steer it in interesting and fruitful directions. In other words, this workshop will have many *leaders* and many opportunities for interesting and fruitful excursions. This should help ensure that it is intellectually exciting for all involved. This workshop directly ties into the paper that I will be presenting at PDC '02 which provides a strong link and contextual background for the workshop.

According to Alexander (1977), "A pattern is a careful description of a perennial solution to a recurring problem within a building context, describing one of the configurations which brings life to a building." He describes a pattern language as, "a network of patterns that call upon one another. Patterns help us remember insights and knowledge about design and can be used in combination to create solutions." Alexander, for example, proposes "small meeting rooms" as pattern #151 and "Half hidden garden" as pattern #111.

We are using Alexander's constructs (basically "semi-structured information") as the basis of our project. Like Alexander, we are interested in systems that are more convivial. We are also interested in design. We, however, are focusing our attention on communication systems, not systems related to architecture and building. Our core precept is that certain forms of information and communication systems are likely to be more effective at promoting conviviality in the human and environmental spheres. These systems are also more "authentic" and more equitable; unlike, for example, commercial television whose product is designed to sell merchandise, constructed by professionals with commercial – not civic or community – allegiances, fosters damaging stereotypes, is often unanswerable to the public, and is likely to be the conduit of propaganda. Thus the systems we hope to promote are more likely to be equitable and participatory. They will support what I've called in my book (Schuler, 1996) the six "community core values," conviviality and culture; education; strong democracy; health and well being; economic equity, opportunity, and sustainability; and information and communication.

This project capitalizes on several notable aspects of our era:

- Intense interest and influence in civil society worldwide.
- Increasing penetration of the Internet and the World Wide Web with attendant potential for global collaboration.
- Need for a "network-based" representation of the wide variety of thoughts and approaches related to community and civic uses of ICT worldwide.

We believe that a useful and compelling pattern language is possible (Alexander's "A Pattern Language" is an existence proof) and that we can develop one in an efficient collective, participatory way. Our strategies for developing and disseminating the pattern language are listed below:

- Use patterns as an orienting theme for a conference and information structure.
- Use a common format to facilitate pattern integration.
- Develop and refine appropriate participatory processes (combining in-person and virtual interactions) that support each phase of the development of patterns and the pattern language.
- Develop an easy-to-use web application that supports every aspect of the process including pattern submission and review, and pattern language development, access and use, and evolution.
- Publicize the web site and encourage people to post their patterns.
- Provide a scholarly avenue for pattern development and presentation (while also making the project accessible to a non-academic audience).
- Build on successes of previous DIAC symposia and the worldwide community that has evolved over the past several years.
- Work on an ongoing basis to evaluate the process and to explore the pertinent issues (including a preliminary history and analysis of the social and technical processes).

Each phase of the project has an associated "community" and "output" that is created during that phase. The type of participation has been determined largely by the community that has been involved and what needs to take place at that particular phase. The phases as we are now defining them are as follows: (1) conceiving project; (2) developing and marketing project; (3) entering patterns; (4) reviewing patterns for presentation; (5) language development; (6) language review; (7) process evaluation and critique; (8) final edits; (9) language evolution; (10) language evolution.

OBJECTIVES

This workshop is intended to be collaborative. I am telling the story of our participatory project and I'm hoping to hear their feedback based on their expertise, values, and judgement. I believe that our interactions will help me in moving the project forward and I'm trusting that the time the attendees spend in the workshop will be helpful to them in their work.

The objectives, both general and specific; for me and for participants are as follows:

- Move pattern language forward (refine patterns and/or language; make process more participatory)
- Get participatory design community involved in a long-term way on project
- Evaluate / critique the project so far
- Surface ideas for deeper and more effective participation in process
- Add new patterns (especially related to participatory design) and insert more participation within the patterns themselves

Workshop Plan

The plan is very basic but can be modified based on feedback from workshop reviewers or from participants themselves. It is a pared-down version of "Open Space Technology" in which participants largely determine the agenda based upon some initial constraints established by the convenor.

1. Workshop begins with a brief discussion of the project; its intent, rationale, approach status. I will have the set of patterns with me and I will use one or two as examples. If at all possible I plan to display the patterns along the wall in the order that the group at DIAC-02 put them in. There will be some brief discussion about this and I will answer questions. I'll also outline the basic plan for the workshop and distribute the list of critical questions (next section).

2. For about 15 minutes participants are encouraged to browse the patterns, mill around and discuss the patterns, the intent, and the process.

3. Participants offer their ideas for small group discussions that they'd like to organize. These ideas are written down on a white board. These ideas can come from the critical questions list or their own imagination. People can also use a pattern or a set of patterns as their focus. There will be some discussion as to whether the topic is too broad or too narrow or whether groups should merge or split.

4. Break into small groups based on the agenda items to discuss the agenda item to develop recommendations.

5. Discussion, reporting back, recommendations

CRITICAL QUESTIONS

How can we improve the quality of the participation in the process to come?

What could we have done to improve the quality of the process already passed?

What new patterns can we add to explicitly add participatory design to the language?

How can we integrate participatory design orientation and methodology into existing patterns?

How could / should patterns-in-work be annotated on paper and online to support integration into the pattern language?

What observations, theories, recommendations could be integrated into the text that ultimately will describe the pattern language and how it should be used?

How should the pattern management system be improved? What new functionality should be added?

How does our choice of artifacts (patterns / pattern language) shape the outcome of the project (both positively and negatively)?

How does our particular approach to this project shape the outcome of the project (both positively and negatively)?

WORKSHOP PARAMETERS

I'm willing to work on this with just about any number of participants since we will be breaking into smaller groups anyway. A larger number of people would just mean more smaller groups. I am, however, envisioning between 10 and 50 people. The workshop doesn't require any computer support although a computer connected to the Internet with associated display capabilities would probably be useful in displaying the full patterns and the capabilities of the online pattern management system (diac.cpsr.org/conferences/diac02/patterns.cgi). I will be bringing the pattern set (150-250 patterns) in paper form and ideally these could be taped to a wall in the workshop room. The workshop should be anywhere from 1.5 to 3 hours.

Anybody at PDC would be welcome to attend this workshop. People who are interested in the design and development of socially responsible ICT; broad, multi-phased participatory design projects, and emergent, collective, networked knowledge representation would make excellent participants. Anybody with familiarity with Alexander's work would bring in important insights as well.

WORKSHOP CONVENOR

Doug Schuler, the workshop convenor, has been working in the area of social responsibility in computer systems for over 20 years. He is a co-founder of the Seattle Community Network (http://www.scn.org) and has authored and edited several books and articles on these topics and has presented at many locations around the world. He is currently a member of the faculty at The Evergreen State College where he teaches programs related to computers and society. In the fall of 2002 he will again co-teach Community Information Systems, a year-long program for 50 students who will work with communities around the world to co-develop web applications to support the communities.

Towards IT-support for shop floor working groups

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ABSTRACT
Many manufacturing enterprises introduce various forms of flexible work organization on the shop floor. However, existing computer-based production planning and control systems pose severe obstacles for self-governing or autonomous working groups and other kinds of shop floor control to become reality. The intention of this workshop is generate discussions on how to support responsible self-governing groups of workers in their situated planning, management and coordination of the activities on the shop floor. Findings from field studies of self-governing working groups in six manufacturing companies are reported and will be used for initiating the discussions.

Keywords
Shop floor work, self-governing groups, coordination, work planning and management, IT-support.

BACKGROUND
For most of the 20th century, manufacturing has epitomized a work organization characterized by radically centralized and very detailed and rigid regulation of work in which the individual's sphere of activity is reduced to a small repertoire of monotonous movements. However, a series of fundamental changes over the last two decades have placed the issue of the work organization in manufacturing on the agenda again. Faced with turbulent markets, industrial enterprises are opting for strategies that involve shorter product life cycles and increasing product diversification, which in turn requires a reduction of inventories and buffer stocks, extremely short lead times, shrinking batch sizes, concurrent processing of multiple different products and orders, etc. To meet these requirements, industrial work organizations must be able to adapt rapidly and diligently to changing demands in a concerted and integrated way.

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To cope with these demands, a large number of manufacturing enterprises are now trying to introduce various form of flexible work organizations on the shop floor, usually characterized by increased local control over job allocation production planning, etc.

The existing IT support systems are, however, designed for an entirely different purpose and do not support these working groups properly. For example, orderly coordination is accomplished through the local actions and interactions of actors who have only local control. The presumptions of centralized materials-and-resource-planning systems (MRP), that the planning department of the enterprise is able to predict and control, in essence, the manifold interdependent activities of a manufacturing enterprise, is illusory, and in flexible manufacturing the enormous systemic costs of maintaining this illusion have become evident.

This delegation of power and responsibilities to working groups, and demands for re-thinking the approaches for providing IT-support for shop floor workers, introduce a series of new and interesting challenges for the field of participatory design.

ISSUES OF CONCERN
The aim of this workshop is to initiate discussions on proper approaches, relevant requirements, useful facilities, etc. when investigating possibilities and designing applicable IT-based systems for shop floor working groups. Such systems could, among others, support the working groups in coordinating and managing tasks such as activity planning, staffing, scheduling and re-scheduling, negotiations, etc.

Issues to be addressed will cover (not exclusively):

- The nature of shop floor work.
- Central characteristics of the situated planing, management and coordination on the shop floor.
- Requirements for IT support systems for self-governing groups.

- Design-principles and architectures for IT support systems for self-governing groups.

The discussions will address relevant approaches for designing this type of systems, requirements for such systems, potentials of the information technology of today. We encourage, participants from different areas like PD, CSCW, HCI, Engineering and design, and practitioners to participate and get involved in a cross-disciplinary discussion. We hope to attract participants that have knowledge about and experiences from action research and field studies in shop floor environments, and/or design cases and prototypes of systems for shop floor working groups.

WORKSHOP ORGANIZATION

Participants are encouraged to submit position papers (1-3 pages) to the organizers. The position papers are optional but most welcomed. Position papers received by June 15 will be e-mailed to the participants before the workshop.

The organizers will provide detailed presentations of findings from the six case studies conducted at Danish manufacturing companies. These will present central findings on how the work is undertaken, the prime challenges for self-governing groups with respect to planing and managing their work activities, and overall requirements for IT-support of this work. We might also present an illustration prototype of a planning system designed on the basis of our findings in one of the studies.

Hopefully, we will also be able to have one or two others presenting relevant material. This will be selected from the position papers.

Based on the presentations and the participants' own experiences we will finish the workshop with a thorough discussion of the issues listed above and other themes of interest to the participants. This discussion will also address ideas to follow further in the future.

ORGANIZERS

Peter H. Carstensen and Kjeld Schmidt, IT University of Copenhagen. Kjeld has a background in sociology and has for many years been a central player in the field for CSCW. He is the coordinating editor of the CSCW Journal. Peter holds a Ph.D. in Computer Science and is head the Department of Design and Use of IT at the IT University of Copenhagen. Peter also has his prime interest in CSCW.

They have both conducted a large number of field studies, and they have been involved in a number of studies of shop floor working groups in relation to the FASIT project (cf. http://cs.aue.auc.dk/fasit/) and the IDAK project (cf. http://cs.aue.auc.dk/idak/). These projects have undertaken studies in six large Danish manufacturing companies, established a series of requirements for IT support, and developed an illustration prototype of a planning system for a shop floor working group. Results from these projects can, amongst others be found in [1, 2]

ACKNOWLEDGMENTS

The IDAK project is supported by Industriens Uddannelsesfond. The project was conceived and initiated by Irene Odgaard of the Central Organization of Danish Industrial Workers (CO-Industri) whose support is gratefully acknowledged. We are indebted to the workers and managers at the six companies for having given the project their support, their interest, and their time.

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Designing Tangible User Interfaces to Support Participation

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ABSTRACT
This workshop addresses design aspects of tangible user interfaces (TUIs). Particular focus is put on TUIs that support collaboration, and on how a participatory design process for such TUIs can be organized. The workshop will demonstrate examples of collaborative, tangible user interfaces, and allow participants for hand-on experiences with the examples. Further, participants at the workshop will discuss possibilities and experiences of using role plays during the design process for enhancing understanding of the system. Finally participants will discuss questions raised by the organizers in this proposal and by participant during the workshop or in positions statements.

Keywords
Tangible user interfaces, collaborative interfaces, participatory design, role plays

INTRODUCTION
Tangible Interfaces are of increasing interest in research and are beginning to show their potential for practical applications. As tangible interfaces differ in many aspects from classical WIMP interaction with monitor-mouse-keyboard *and* from interaction with virtual realities, there are no standard answers for design issues. Hardware and software need to be designed as a well-integrated unit to fit into physical interaction with the tangible, digital interface. In addition tangible interfaces show great potential for supporting collaborative situations (e.g. in participatory design), thus necessitating a different approach to design as well. These two aspects affect both the resulting design (design recommendations, good examples of design) and the process of design (e.g. assessing and evaluating systems).

Goals and Objectives
The workshop aims to bring together existing experience about the design of tangible interfaces and to discuss tangible interaction. Aorative, tangible interaction The workshop will address these questions special focus will be on design for collab:

- What do we consider to be a good tangible interface?
- In which kind of work processes and activities to we prefer tangible interfaces as opposed to 'ordinary' interfaces?
- What should the design process for collaborative, tangible digital interfaces look like?
- How can the design of these interfaces (their efficacy and usability) be assessed?
- What specific problems of collaborative work processes are important to address when designing tangible interfaces?

Methods
The first portion of the workshop will consist of hands-on experience of tangible interfaces. The workshop organizers will use role play to demonstrate examples of tangible interfaces that have been developed at their respective research groups. Participants are encouraged to bring along and demonstrate examples of tangible interfaces from their own research.

During the second portion of the workshop participants will discuss the various systems presented and the usefulness of role play for enhancing their understanding of the systems.

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The final session will focus on developing responses to the questions raised in this workshop description as well as any raised by position papers, and to outline new issues and questions that are of importance for future work.

System examples from organizer's research

The following two systems represent work in the area of TUIs by the organizers.

The Envisionment and Discovery Collaboratory (EDC) Participate-in-the-Action Board (PitA-Board)—L^{3}D, Boulder

The EDC is an early prototype of an integrated environment to support community participation. Building upon the experience of using physical, game-like methods in participatory neighborhood development, the system is inspired by the game board of physical design games, but augments the tactile aspects of physical game pieces with the dynamic capabilities of computational simulation.

The most recent version of the EDC uses the PitA-Board as its interactive interface. The PitA-Board has the format of a large chessboard and is able to detect sensorized graspable tokens placed on its squares. The underlying technology consists of a grid of 2-inch-square antennas that can sense location and identity of 15 distinct transducer coils that can be imbedded in physical objects, allowing for multiple cursors and simultaneous interactions. Interaction with the system is done entirely with tokens, which can be either used as interaction objects or as specialized tools. The board is visually augmented by a top-projected simulation. One application of the PitABoards supports neighbourhood participation in transportation planning. A map is projected onto the board and residents place house tokens onto the map, mark important areas (shopping mall, schools) discuss the existing bus route and design a new route with stops, aided by simulation facilities of the system.

The Generic Tag & Track Table (K3, Malmö).

This TUI is developed by students at K3, Nicklas Nilsson and Micke Rundberg, supervised by Lone Malmborg. The TUI table is designed for two different interaction design applications. Both applications are directed towards augmentation of – very different – creative processes. The first is called Tabletop Wireless Tracking System [TWEET]. TWEET is a design proposal for the tangible interface of a multitrack audio mixer. In the first stage six different objects will be placed on the table. Each object represents an audio track in a song. The concept of mixing is that when the user moves an object to the right the sound of the corresponding audio track will be panned right and reverse. When the user moves an object to the back the sound of the corresponding audio track will be lowered in volume and reverse. Primary users are musicians with no interest in learning traditional mixers. The interface is supposed to be used as a rough sketcher in the early mixing stages. The second application is a Sketching tool for designers in collaboration. An area of the Generic Tag & Track Table is set up to support sketching activities with a big display that can hold images from the individuals that are within the area. The display is passive and reflects only the sketching action on the table. For the input to the display, the sketches on the table have to be digitalized. An important point is to preserve the origin of sketching with paper and pen. The feeling of paper as a simple material supports a rapid, open way to drawing which is hard to achieve with a mouse or any other normal computer input device.

Using Role Play to Experience Group Collaboration using TUIs

Using a role play method, we will simulate a potential use situation for the PitA-Board. Participants play roles of inhabitants of a suburb, whose bus route connecting it to the city needs to be improved. (This method has been used previously for assessment of the system.) The map of the neighbourhood and results of interaction (and simulation) are top-projected onto it.

If time allows we may also set up role plays for more of the demonstrated TUI examples.

Starting Points for Reflections on Role Play

The use of role play has been a beneficial method for the assessment of early prototypes. Role play can be used within the researcher group, testing general interaction issues and doing rough testing, and with external subjects. Role play allows the observation of group processes with the system, it can evoke emotions and conflict, thus approximating potential live situations, and gives external participants a chance to base their feedback on hands-on experience. The scenarios should attempt to touch issues of real-world relevance, avoiding laboratory situations and detached problem solving.

It is also important to understand where problems with and limitations of role play lie. One problem we have experienced is that participants may fail to take on the voice of their persona. Another is that the design of scenarios needs to be complicated enough to be realistic, but not so complicated that it becomes unmanageable. Designing role plays that are effective for assessment and feedback also requires the development of facilitation techniques supporting the group processes for collaboration.

If time permits, we can also explore other uses of role play, including a short video from the Interactive Institute with examples of role play and drama techniques used in industry, utilizing simple things as props for imagining the usage of future technologies.

PARTICIPATION

Intended Participants

We hope to generate dialog among those involved in developing hardware and software for tangible user interfaces, those involved in applying technology to collaborative processes, and those engaged in assessing the usability and efficacy of such environments.

Maximum Number of Participants

In order to allow workshop participants to engage in role plays and to try out TUI's the number of participants is limited to 20.

Participant Preparation

Participants are welcome to send us a short (1-2 page) position statement by e-mail (until June 10) for the workshop. We will make these available via the PDC website. Position statements can also be prepared for short presentation during the workshop. We encourage anyone who has been working in this area to bring along and demonstrate TUI examples. If you wish to bring along such systems, please inform the workshop organizers, so that time can be provided in the schedule for your demonstration. We would also like to know if special presentation equipment is needed.

Hal Eden has worked on the Envisionment and Discovery Collaboratory since 1996, developing wizard-of-oz studies, mockups, initial prototypes, and the current PitA-Board.

Eva Hornecker has worked on a development project within the 'Real Reality' graspable user interface approach, facilitating synchronous modelling in real and virtual worlds. She is now doing her Ph.D. on cooperative interaction with graspable interfaces and resulting design issues, and has done empirical work using video-analysis and role-play on this topic.

Lone Malmborg is currently heading the Creative Environments Research Studio at Arts and Communication, Malmö University. Her interests include interaction design technologies and concepts, and she has set up and headed an education program at Arts and Communication in this area.

Special Equipment needed:

Power Supply, probably video equipment, and possibility to mount top-projection.

Flipchart, several pin boards, post-it notes

Social Formations of PD - Living Archaeology

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ABSTRACT
This workshop is organized to contextualize technology development movements like PD as contingent, sociopolitical formations, and to construct alternative questions to be asked of such technology development efforts.

Keywords
History, technology development, dominant paths, reflexivity, contingency.

RATIONALE AND OBJECTIVES

The workshop responds to the call in this year's conference theme to "inquire the politics, contexts and practices of collaborative design work" and "the transition from what we learn from studies of work practices and social interactions to the design of a system, application or other design products." In addressing this call, this workshop is organized to contextualize technology development movements like PD as contingent, sociopolitical formations, and to construct alternative questions to be asked of such technology development efforts.

Through their integration of humanistic and technical knowledges, a rich texture of analytical resources has developed through efforts falling under the rubric of PD (and other movements similarly concerned with the design of technical systems for others). Over time, dominant discourses and forms of doing have developed within, by, and for these movements. Although contingent, these dominant paths have consequences for what are legitimate and relevant questions to ask and what are legitimate and relevant modes of intellectual and practical concern. The workshop is not intended as a "where have we been, where are we going" session. Rather, it aims to explore the contingency of these paths by holding a Pasts Workshop.

Seven scheduled participants (listed below) will address various components of dominant paths within PD and kindred movements, toward identifying a reflexivity that might be developed with respect to participatory design practices.

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ISBN 0-9667818-2-1.

WORKSHOP DESIGN

Building on strategies of a Future Workshop, 20 participants are invited to join seven scheduled presenters to form a participatory design Pasts Workshop. The primary objective of the workshop is to construct a process of understanding the past: what have become dominant modes of doing under the rubric of PD, and what might have happened differently? Future workshops tend to take the staged structure of Critique, Fantasy, and Implementation. This Pasts Workshop will likewise entail three structured stages of Critique, Memorial, and Positing as follows.

Critique

A critique stage will be kicked off by brief contributions from seven scheduled participants (listed below) who will address various components of dominant paths within PD and kindred movements. Discussion will be geared toward identifying possible terms of critique.

Memorial

Following a short time for writing, all workshop participants will be asked to consider these critiques as related to possible alternative pasts. The objective of this discussion is to identify 3-5 clustering themes. Once identified, these themes will provide the point of departure for small group discussions along three issues: (1) identifying aspects of PD pasts that today might be sought to have been otherwise? (2) what social processes shaped this formation, and in what senses are these transformable? (3) what might a different past lived by participatory design formations look like?

Re-Positing

Each of the groups will then be brought back together to re-posit pasts for participatory design formations. What could and could not have been otherwise?

SEVEN SCHEDULED PARTICIPANTS WILL ADDRESS THE FOLLOWING TOPICS.

Ellen Balka, School of Communication and ATIC Design Lab, Simon Fraser University.

Where the gender is in participatory design processes

Although it has often been suggested that participatory design has feminist roots, issues related to how gender and other differences are addressed within the context of design projects and on design teams has largely escaped critical scrutiny. Participatory design, like other forms of design, is a process (or a series of processes), that is situated within broader socio-political formations, and yet we have seldom looked at where gender is in that process, or how it operates within participatory design processes. In my presentation I will explore "where gender is" in participatory design processes, by using Harding's (1996) view of gender as an analytic tool to make sense of design team dynamics and processes. In particular I will focus on the gendered nature of expertise. My findings-- (based on analysis of interviews with participatory design and ergonomic practitioners) suggest a focus on design as process, and an emphasis on desired outcomes of participation, will bring us closer to realizing the ambitious goals of participatory design.

Sisse Finken, Dept. of Communication, Journalism and Computer Science, Roskilde University.

Domains of Knowledge

I would like to think about discourses: how they aren't just out there somewhere or just pop up out of the blue. To see them, rather, as productive instruments that are produced by and within certain formations within certain institutions. I would like to take this path and think about it in relation to the notion of the expert and his/her rights of access to the discourse of IT. To think about how Participatory Design as a domain of knowledge gives meaning to what systems development/design is and becomes when it is being thought, talked about and seen as a buffer for the ones who are affected by the technology being designed.

Joan Fujimura, Dept. of Sociology, University of Wisconsin

To be announced.

Randi Markussen, Dept. of Information and Media Studies, University of Aarhus

Participatory design and partial connections

"Nothing can substitute for loss of conviction but a new conviction". (M.Strathern 1991:38). Feminists and other scholars engaged in technoscience have argued that giving up on a priori assumptions about what counts as nature versus culture technology versus work organization, experiment and design versus historical and sociological analysis opens a space for not only questioning dominant ideas of technology, but for alternative visions of knowledge construction and engagement. A new vocabulary is taking shape: We are in a world made up of cyborgs, material semiotic networks, partial connections and situated knowledges to mention some important terms that encourage us to explore practices 'in practice'. I will discuss some of the implications of the approach with examples from a study of the incorporation of an electronic medication module at a plastic surgery ward that Finn Olesen and I did; I would like especially to focus on how we may account for participation.

Finn Olesen, Dept. of Information and Media Studies, University of Aarhus

The Materiality of Technology

In this conversation I would like to take up the often neglected or taken-for-granted theme of the material dimensions of technology. In a sense it is trivial to say that technology is material; but what does it mean to make this claim? Does it mean that certain invariant, physical properties are constituent parts of the technological artefact in question - a cartesian/objectivist assumption. Does it mean that material world is the foundation of technology, as it is of all life - a marxist assumption. Does it mean that materiality is a non-idealist, anti-positivist, but undefined claim of social studies of technology - a discursive assumption. Or does it mean that materiality is a dynamic side to the material-semiotic practices of situated figurations, especially of technoscience - a cyborgian assumption. - All these different assumptions about the materiality of technology are applied in theories and practices, but (how) do we separate them, at what price, and with what benefits?

Lucy Suchman, Centre for Science Studies, Dept. of Sociology, Lancaster University

Participatory Designs and PD Singularity

Rather than beginning with the premise that Participatory Design is a singularity (e.g. 'movement', discourse, instrumentality), I would like to start with the question of 'participatory designs'; that is, the multiple experiences, identities, desires, etc. that we collectively bring to the workshop and that, presumably, bring us to the larger conference. Within that frame, I would be very interested in a critical contextualisation of PD, including the question of how 'it' acquired its initial caps, what that tells us about the processes through which things come to be configured as singular, and how it might be otherwise. I'm particularly interested in relations between the politics of design as a profession, and the possibilities of design more generally as specific forms of ordering.

Katie Vann, Dept. of Communication, University of California, San Diego

Politics of Articulation

Running through many writings on work and technologies in use is a realization of difference. We might say that it has become a value of PD and like communities that one recognize the differences and relations between the sign embedded in formal systems, on one hand, and its lived excesses, on the other. I am interested in thinking about how these realizations are dealt with in some contemporary studies. I address this issue through a consideration of uses of the concept of articulation work and its relation to pragmatism.

TUTORIAL

Introduction to Participatory Design

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ABSTRACT

This tutorial gives an introduction to Participatory Design (PD) for newcomers to the field. It will be held in the form of a combined seminar/workshop, offering participants a brief history of PD as well as hands-on experience of some of the methods used in PD practice. The instructors are researchers who have taught PD courses for graduate students as well as used PD methods in their own research projects for a number of years.

ORGANIZATION OF THE TUTORIAL

The tutorial will begin as a seminar, during which the organizers will give a brief overview of the research area and history of Participatory Design, as seen from a Scandinavian perspective. After this, we will proceed with a mini-workshop, during which we will try some of the methods used in PD practice. Finally, based mainly on our own experiences, we will discuss benefits as well as challenges of using PD in practice, in student and research projects.

The tutorial as a whole is intended to be informal and interactive. Depending on the number of participants, we may divide into two or three smaller groups during the workshop part.

AIM OF THE TUTORIAL

- To give an introduction to Participatory Design both as a research area and as part of everyday software development practice
- To give an overview of the history of PD
- To offer hands-on experience of some PD methods
- To discuss some of the main themes of PD and what it might mean to try to weave them into teaching and research practices
- To answer questions and explore issues and ideas about PD that are brought up during the tutorial

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AUDIENCE

The tutorial is intended for newcomers to the field of Participatory Design, people who wish to get an introduction to and overview of PD in connection with attending PDC2002.

ABOUT THE TUTORIAL ORGANIZERS

The organizers of the tutorial are all from the Department of Human Work Science and Media Technology at the Blekinge Institute of Technology in Southern Sweden.

Annelie Ekelin is a Ph D student who is focusing on participatory design of community websites in her research work. She has a BA with a major in ethnology, a diploma in librarianship, and has worked as a journalist and librarian. Annelie has been involved in several research projects focusing on the social construction of technology in use during the past three years.

Pirjo Elovaara is a PhD student who has a Technology Licentiate degree in Technoscience Studies. Her current research project is about national Swedish information technology politics and their local interpretations. Pirjo focuses on the collaboration between different human actors, as well as a number of non-human actors, in the development and shaping of both municipal web sites and local IT projects. She has been developing and co-constructing local and regional IT projects and IT training activities for several years.

Sara Eriksén is an assistant professor, with a Ph.D. in Informatics from Lund University, Sweden. She has taught PD courses for graduate students at Blekinge Institute of Technology for a number of years. Before that, in 1989-95, she worked as a consultant, developing municipal information systems, a job where the employer deliberately encouraged and supported the use of PD methods. Her current research project concerns participatory design and development of IT in use in public service one-stop shops and on-line public service systems.

AUTHOR INDEX

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