Cultural Usability

The Effects of Culture on Usability Test

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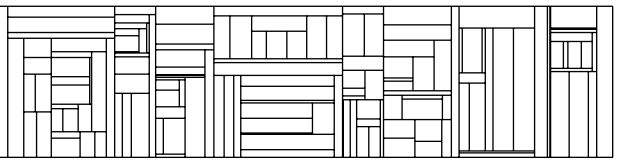

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O. W. Bertelsen, M. Brynskov, P. Dalsgaard, O. S. Iversen, M. G. Petersen, M. Wetterstrand

University of Aarhus

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Preface

Since 2001 the annual Danish Human-Computer Interaction Research Symposium has been a platform for networking, and provided an opportunity to get an overview across the various parts of the Danish HCI research scene. For this years symposium we received a record number of 28 submissions, that after being reviewed by the organizing committee, all were accepted. The accepted papers included in the proceedings present work in progress as well as summaries of resent work. In order to accommodate the large number of papers the standard mode of presentation at the symposium is the poster. A small number of papers are selected for oral presentation in plenary. In addition to the paper presentations the symposium features two keynote lectures. We would like to thank all contributors. The symposium would not have been possible without generous administrative assistance from the Department of Computer Science. The keynote lecture by Mark Gross has been sponsored by Center for Interactive Spaces, interactivespaces.net. We are thankful for the support. The Danish HCI Research symposium is organized in collaboration with SIGCHI.dk.

University of Aarhus,
November 2006

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Martin Brynskov,
Peter Dalsgård,
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Towards a Value Theory of the Interface

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INTRODUCTION

In this paper we will look at the analysis of user interface problems from the point of view of the political economy of signs. We will demonstrate how the concepts of sign value and symbolic order enable us to make a structured account of issues in the interface that are normally seen as belonging to residual categories. We illustrate the argument through the reconsideration of the case of commercial oven use in hospital kitchens.

CONCEPTS OF SIGN AND SYMBOL

Critical theories of commodities and life in capitalist society often departs from Marx' value theory, which outlines two different values operating in social life, namely Use value and Exchange Value. Baudrillard (1981) extends Marx's analysis of commodity to incorporate the logic of semiotic value, called sign value, as well as deep structures in our sub-conscious, called symbolic exchange. This extension aims to extend Marxist value theory to address exchange in the cultural sphere and its mediated effect on material production.

In Baudrillard's analysis *Use value* is the value determined by the utility an individual could have from an object. *Exchange value* is the value an object could be quantitatively converted to by exchange with another partner. These two categories are the same as in Marxist analysis of commodity. However, Baudrillard adds the following: *Sign value* is the value arising from differentiation. Possession of an object potentially differentiates the holder from others, thus creating sign value. Consumption is here defined as the production of sign value. Example: a well-designed company logo has the characteristic that it makes the company stand out from other companies. It could thus be seen as a holder of a high sign value. An individual wearing and thus consuming a special mix of clothes could be perceived by his or her environment (and by himself or herself as well, of course) as having a unique style. The mix of clothes and accessories could thus hold a high sign value. This is an example of a value that not everybody tries to maximize for different social reasons, for instance since the individual may strive for a somewhat conformal identity. As a consequence of this, sign value only makes sense when the individual is related to other people. *Symbolic exchange* concerns deeper pre-logical categories in the individual mind. It differs from the other value categories by being inherently contradictory, since we often satisfy some aspects of our deeper feelings at the expense of others. As a consequence, there may be more or less optimal levels of symbol values, but such a thing as an absolute maximum symbol value does not exist. The satisfaction of some deeper emotional feelings, or *jouissance*, belongs in this category. It should be noted, as for objects, they possess no symbol value. The logic of symbolic exchanges transgresses all the other three values. They cannot be quantified and made equivalents to other Things, and thus they are the only sphere of the human life-world which can defy integration in the market economy. In objects, there is no symbolic value, but there is according to Baudrillard a value logic of symbolic exchange. There are many bids on what this logic beyond the rational and conscious is; the attempt to solve the issue of the nature of the symbolic domain is of course beyond this paper. Nevertheless, it is interesting to assume the existence of a value logic opposing the logic of use, exchange and sign value.

VALUE ANALYSIS OF OVEN USE IN A HOSPITAL KITCHEN – FROM "FOOD" TO "PATIENT FOOD"

To illustrate how the value theory of the interface can be based on Baudrillard's analysis, we revisit the example of commercial oven use in hospital kitchens (Bertelsen et al., 2003). An aspect of particular interest in this study was the advanced features, e.g. the possibility of users storing often used sequences of heating, timing, and measuring, in the oven (so called programming).

In the observed kitchens the programming features of the oven were sparsely used, or not used at all. Instead, kitchens have binders in which they store oven operating procedures. Initially, it was believed that the interface of the ovens was too awkward for the users to program, and thus explains the missing appropriation of the programming functions. However, closer studies showed that the non-appropriation could not be reduced to breakdown in pure use-value (e.g. in a relation between kitchen personnel and wrongly heated or delayed food due to mistakes in programming). The problem could thus not be reduced to an individualized usability problem.

Potentially, users could save some time by not typing in the instructions to the oven each time. In addition, they could also by increased automation and less errors increase economic productivity, and thus increase the exchange values produced, i.e. produce more food to a lower price, and without extra costs. This somewhat tayloristic perspective is

easy to see for all actors in the case. In an exchange value-maximizing economy, as well as in a world ruled by what is most useful, we should expect appropriation to take place, yet this did not happen with the programming features of the ovens.

Bertelsen et al. (2003) describe this phenomenon as an organizational issue. As an alternative, in the present paper, we will suggest that to gain a full understanding of the appropriation issue, we need to take a look at the sign value, in a Baudrillardian sense. First, we should then look for if sign values are produced, and if so, what sign values. It turns out that in the case of the oven, a sign production is created, where ordinary raw eatables are becomes "locally produced patient food".

The food served for the patients in the hospital is not just any food; it must be food certified with certain procedures, cooked with the right temperature, being stored within certain intervals etc. In the process of cooking, not only is the food prepared in order to satisfy human needs, it is also differentiated from all other already existing instances of food. In particular hospital food is characterized by having reached certain temperatures at specified stages of the preparation process.

The binders reify norms and division of labour; they are central coordinating artefact of the kitchen, embodying the praxis on how to create sign values correctly. It is not a tenable position to reduce what is reified in the binders to use and exchange logic, even though that those logics are *also* in place.

How hospital kitchen cooking meets some human needs can be captured in the use and exchange value logic. Exactly which food is cooked is then governed by the rules in the system. This analysis does however not catch that "locally produced patient food" is not determined inside the local activity. Rather it is determined according to the system of signs (what Baudrillard calls "the code"), which is a complex relation involving a very large number of objects, historically produced in human activity.

Health authorities, medical researchers and doctors at the local hospital, etc. have no human representatives in the kitchen, but their regulations put reference to all procedures there. It is possible to change the order of signs in the kitchen by starting to program the oven, but the (sign) consequences are subtle and hard to comprehend. Is it really still going to be accepted as "locally produced patient food"? Although the kitchen personnel are in full control over the material circumstances in the kitchen, it seems that the institution (some unidentified actor or group of actors) has responsibilities that the individual in the kitchen cannot control. Even if they are comprehendible, they may be difficult to change; it may be a coordinative task requiring much knowledge of the administration of a hospital. To store the cooking sequence as a program in the oven as a disruption of these reified orders.

DISCUSSION

The first insight gained by the value theory is that Sign value creates strong connections to another artefact, the binder. This relation is awkward to describe in terms of contradictions in use and exchange. The second insight is while use logics and sign logics are transparent and understandable, sign values, and especially change of sign values, are opaque.

It activity theoretical HCI work inspired by the Engeström tradition it has been understood as a strength that the construct of the primary contradiction between use value and exchange value, penetrating the entire activity system, has been seen as a universal source of instability and dynamics. It has, however, been equally complicated to give concrete meaning, beyond the abstracted dynamism, to the contradictions when it comes to specific cases.

The analytical framework of the value theory of the sign provides us with a handle for a fuller understanding of basic dynamics of the use situation. We are not only dealing with the dialectics between use and exchange values, but also, and possibly more importantly, with the process of differentiation of sign production in consumption. In the oven case, it becomes clear that the process in the oven is to a large extent a process of sign value production; ingredients are turned into patient food, by measurement of the appropriate temperature. In contrast, gourmet food is produced by differentiating it through artistic chef activity.

In design oriented terms our analysis points to the necessity of designers' engagement in understanding the processes of sign production and differentiation around the interface; for instance by exploring the central elements of the considered domain is differentiated. An issue not discussed extensively in this paper is the symbolic order, and in particular how this could be a handle for a systematic treatment of a broad collection of otherwise residual categories at the interface. This could be a step in a more advanced, and even design-oriented, understanding of how use qualities are constituted, preserved and developed in use. This would most likely lead to design-strategies for open artefacts that lend themselves to the non-economic sphere of symbolic exchange.

ACKNOWLEDGMENTS

Thanks to Toke Eskildsen and Werner Sperschneider for collaboration in the oven project.

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Design Patterns in Ubiquitous User Interface Design

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ABSTRACT
In this paper, I will describe the concept of design patterns and pattern languages with departure in the original pattern language by Alexander [1] as a means for capturing and sharing design experiences. I will identify key concepts in design patterns that relate to HCI and ubiquitous interaction and discuss the challenges in crating a pattern language for Ubiquitous User Interface Design (UUID).

INTRODUCTION
The first well-established and utilized pattern language for architecture was developed by Christopher Alexander and colleagues at the University of California, Berkeley. The overall purpose of the pattern language presented in [1] was to provide architects and users with a shared tool in design: "*The emphasis here was on an entire language for design, since the usefulness of patterns was not only in providing solutions to common problems, but also in seeing how they intertwined and affected one another.*"([4],p. 234)

With the publication of [6], design patterns were introduced into the field of object oriented software design with great success as a means for capturing and sharing good design solutions. Conceptually, Alexander's original idea of design patterns and pattern languages corresponds even better to the challenges we face within HCI and ubiquitous computing. However, the use of design patterns in HCI and user interface design suffers from the lack of design principles by which to guide the structure and organization of the individual patterns. [12] argue that it is neither possible nor meaningful to try to structure patterns into a language before concrete patterns exist. I only agree partly and will instead argue that creating design patterns and a pattern language for e.g. ubiquitous computing requires a combination of a bottom-up approach where we draw on our concrete design experiences for creating the specific patterns and a top-down approach that provides an overall conceptual structure or design philosophy. Concrete patterns do not magically fall into a hierarchical structure when they reach a critical mass. Building a pattern language requires a clear understanding of what you are aiming for to structure and develop patterns for a specific context and language as much as a number of concrete patterns available at any given point in time. It is undoubtedly easier to work bottom-up than top-down when developing a pattern language, but I will argue that if we do not keep the overall structuring principle in mind, our organization of the patterns will become fragmented and random. Furthermore, a clear organizing principle will guide us in identifying more patterns by asking questions about how to solve a given problem and thus help us formulate relevant patterns for this, helping us to progress downwards in the hierarchy.

KEY ELEMENTS OF DESIGN PATTERNS
In the following, I will describe key elements of the original design pattern idea that relate, methodologically, to the way we have and still do work cooperatively, iteratively and crossdisciplinarily with interface design and HCI in general.

Design patterns are dynamic: "*You see then that the patterns are very much alive and evolving. In fact, if you like, each pattern may be looked upon as a hypothesis like one of the hypotheses of science. In this sense, each pattern represents our current best guess as to what arrangement of the physical environment will work to solve the problem presented.*" ([1], p. xv)

This corresponds well with the focus on an iterative design process within the HCI community and the understanding that design of technology is an evolving process that can only be fully understood and evaluated in use (e.g. [3])

Design patterns are always part of a larger whole: "*In short, no pattern is an isolated entity. Each pattern can exist in the world, only to the extent that is supported by other patterns: the larger patterns in which it is embedded, the patterns of the same size that surrounds it, and the smaller patterns which are embedded in it.*" ([1], p. xiii)

This corresponds well with the classic understanding of cooperative design which states that design of artifacts is more than designing the physical "thing"; we also design conditions for human use (e.g. [5,7]). Furthermore, [2,10], both discus that new technology cannot be developed without considering the already existing systems in use, as well as the use practice in which it is to be introduced.

Patterns and pattern languages are based on design experience and supports interdisciplinary collaboration: "*It is a language that we have distilled from our own building and planning efforts over the last eight years. You can use it to work with your neighbors, to improve your town and neighborhood.*" ([1], p. x)

Thus, the design patterns are conceived as a tool, not only for architects, but for all stakeholders in a design project, enabling them to communicate and work together around a given project.

This corresponds well to the classic cooperative design approach presented in e.g. [7], which understands design as a cooperative, iterative process which crosses boundaries between work practices and which must involve active participation from relevant stakeholders to be truly successful. This approach is still prevalent in HCI research today, exemplified in the work of e.g. [8], dealing with design of technology for and which children, [10], dealing with mobile work and the design of mobile technology to support it, and [11], dealing with design of technology for the home.

DESIGNING A UUID PATTERN LANGUAGE

Design patterns for ubiquitous computing are gradually gaining attention, particularly with respect to the prospect of having a tool that allows for more rapid dissemination of "*new interaction techniques and evaluation results by presenting it in a form more usable to designers*" ([4], p. 233). Design patterns can be used to document lessons already learned in the field of ubiquitous computing and thus help inform the design of ubiquitous technology [9]. However, common to the efforts described in [4,9] is the lack of a design principle to support the formation of a pattern language. Despite their argument that the field is not mature enough – i.e. lacking a sufficient number of ubiquitous patterns – they acknowledge the importance of making a structured effort in capturing design experiences. I see this as excellent starting point for showing the strength of a combined top-down and bottom-up approach in generating and structuring a coherent pattern language for ubiquitous user interface design which corresponds well to one of the main goals of the UUID project that I am currently working in, namely to produce a strong framework for designing ubiquitous user interfaces with a solid foundation in theory.

Key questions to be answered with regards to creating design patterns and a pattern language for UUID include:

1. What is the theoretical foundation for the UUID pattern language we propose? Promising candidates include activity theory and embodied interaction. (This is also one of the general goals of the UUID project)
2. What is the underlying philosophy by which we structure the patterns into a UUID pattern language?
3. What describes the overall ordering principle? Spatial and temporal expansion? Deconstruction of problems - scale? The design process itself?
4. What is a relevant granularity and scope of the pattern language?
5. How do we perceive the relationship between levels and groups of patterns in the pattern language (e.g. specialization, instance-of, related to, etc.)?
6. How can we begin to describe "the quality without a name" in ubiquitous user interface design and does the concept make sense in this setting?

SUMMARY

Design patterns show promising prospects for providing concrete design "guidelines" for ubiquitous user interface design and make them available to practitioners. I will look further into developing a pattern language for ubiquitous user interface design within which we may record our and our colleagues' good design experiences as design patterns.

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Visualization of Spam Filter Techniques to Facilitate the Adjustment of Spam Filters

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ABSTRACT
Spam filters are normally evaluated on how effectively they prevent spam from reaching users email boxes. Case studies were performed at 4 danish companies, where it was found that the usability of spam filters does not rely on efficiency alone. The requirements of both employees and IT administrators have to be considered, and the techniques must match the company's specific needs. We recommend that IT administrators should be better able to see, which filtering techniques are the most appropiate for their company. The case studies include interviews with IT administrators and employees about how they manage spam in their company and in their daily work. Our study is relevant for designers who are interested in designing monitoring tools for visualizing filtering techniques to make the administration of spam filters more manageable.

Author Keywords
Spam filters, Enterprise spam filters, Open Source spam filters, ASP spam filters, case studies, qualitative interviews, diaries, visualization.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
This article is based in part on the conclusions of our master thesis [1]. The topic of the master thesis was management of spam and spam filters by Danish companies. Spam is an increasing problem which companies have to deal with, because it is time consuming for their employees and IT administrators. In addition, spam represents a security threat to IT systems giving unauthorised access to sensitive information. We use the OECD definition of spam as all unwanted email where the sender is typically forged. Spamincludes commercials, viruses, worms and phishing [2]. We studied four different spam filtering solutions with the purpose of evaluating their usability for the companies. We were interested in how the spam filters solved the companies problems and if they also introduced new problems. The focus of this article is to evaluate IT administrators requirements for their spam filters, what spam filters lack of support and to investigate the possible design of a visualization tool to support IT administrators. This problem is pointed out in [4].

CASE STUDIES
The 4 case studies [1] contain structured, qualitative interviews with 5 IT administrators where they were asked about their companies IT solutions, their spam filters requirements and how they maintained their current spam filters. Similiar interviews were performed with 15 employees from the same companies. Additionally 12 employees from 3 of the companies kept a diary [3] over a period of 5 days. Here they recorded the amount of spam they received and their procedures regarding handling spam. Finally the 12 employees filled out a questionnaire. This questionnaire measured their satisfaction with their company's spam filter, for example had legitimate emails been wrongly classified and how efficiently had the spam filter eradicated spam.

RESULTS OF CASE STUDIES
The 4 companies had 4 different methods to manage spam. A brief overview of these cases [1] follows:

1. Open Source Solution: This case had their own computer department where the spam filters were managed. They used different techniques such as *whitelisting* to make sure that legitimate emails got through, *greylisting* blocking emails temporarily to verify the authenticity of mail servers. They also used *Remote Blacklisting* (RBL) and Collaborative filtering. These techniques connect to central databases with registered mail servers with open mail relays and registered spam emails respectively, to verify the sender and the email content. Furthermore they used statistical Bayesian filtering with a shared dataset.
2. Enterprise Solution: This case also had its own computer department. They used two commercial products, Barracuda Spam Firewall and Symantec Mail Security for SMTP. These products basically use the same techniques as in case 1, but do not greylist. In addition the products contained simple filtering rules for the emails.
3. Application Service Provider (ASP) Solution: This case did not have its own computer department, and therefore outsourced its spam filtering to an ASP, which again basically uses the same techniques as case 2. The IT administrator in case 3 could manage the solution through a web based user interface.
4. None, only a built-in spamfilter for their email clients: This filter was managed by the individual employees with help from an employee with responsibility for the company´s IT systems.

The first three cases had effective spam filters, but case 1 and case 2 spent several years adjusting the filters, whereas case 3 did not. Particularly case 2 spent a lot of time and money stabilizing the solutions. Despite this, some of the employees still received a fairly large amount of spam. Case 4 received a lot of spam and employees were anxious about what the spam might contain. The spam filters were transparent to the employees, a popular feature since employees had previously spent a lot of time removing spam as case 4 does today.

DISCUSSION

Our study shows that IT administrators do not know how well the different techniques in their spam filters perform, and where to adjust the spam filters to get a better result. When employees detect false positives (legitimate emails wrongly classified as spam) they add the sender or the domain address to their spam filter whitelist to ensure these emails are accepted next time. Whitelisting requires administration from the IT administrators, since none of the three cases with spam filters allows users to manage whitelists directly from their email client. The IT administrators did not have alternative methods to prevent similar false positives, they could only continue to update the whitelist.

Case 2 basically whitelisted all their customers since their emails contain links. A single rule in their spam filter prevents emails with links from getting through the filter. Since their customers have to send emails containing links to their advertisements, it is an unfortunate rule for this company. Furthermore, the IT administrators could not know if the RBL and Collaborative filtering classified spam correctly since the emails in question were immediately removed.

Case 1 had good experience with greylisting and saw a reduction in spam emails, but they had no information as to which emails were removed. They only became aware of false positives when the company´s employees contacted them. Also the IT administrators did not know whether their RBL and Collaborative filtering were classifying emails correctly, or how much spam the filters removed in total.

Case 3 did not know how many false positives they actually had. They tried whitelisting some customers, but without success. Therefore the IT adminstrator decided to bypass the filter for paticular senders.

Case 4 did not have a spam filter, but the IT administrator here stated that a future spam filter would have to give the employees access to filtered spam in case the filter removed important emails by mistake.

VISUALIZING SPAM FILTER TECHNIQUES

We recommend a visualization tool that shows which emails a particular technique has classified as spam. The tool should also give a view over which emails were accepted by the filters. The visualization tool should help IT administrators understand which techniques of the spam filter are suited for their company through a graphical user interface. Thereby it would be possible to identify the causes of the false positives. This tool should furthermore give the IT administrators the opportunity to adjust or completely remove techniques and rules not suiting their companies specific requirements [1]. The spam filter therefore need a modular structure to facilitate monitoring and adjustment. Our results indicate a need for IT administrators to have such control since employees do not have access to all the false positives. This solution will also make it possible for the IT administrators to tune the filters when they have a view over which spam emails get through the filters.

CONCLUSION

Reliable email communication is essential for many companies today. Our study shows that companies have to analyze their spam filtering requirements and investigate which spam filter technique is best for them. In order to provide companies with a flexible solution, IT administrators need a visual tool to select which spam filtering techniques to use. Furthermore, IT administrators have to be able to see how effective the spam filtering technique are, and to be able to track which spam filtering techniques result in false positives.

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How do you get developers to care for the itches of others? – Introducing usability to an open source community

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ABSTRACT
The focus of this paper is the study of distribution of knowledge about actual users and actual use to a distributed open source software organization. While there is an increasing use of open source systems in various types of organizations, the assumption is that the types of users and work situations are differentiated. These issues have not been sufficiently explored from within the open source development community, and knowledge about users and use situation need to be investigated and the knowledge disseminated to the development community.

Various attempts to introduce end-user issues are presented. Lastly, in an attempt to understand the preconditions for an understanding of users within an open source development environment, a discussion between members of a usability-oriented fraction within the organization is analyzed. In this analysis, understanding HCI and end-users as boundary objects for the organization discloses how an insufficient coordination and translation of these, for HCI, key terms leads to a flawed organizational implementation of user-centered approaches.

Author Keywords
Open source, usability, HCI, learning, end-users, boundary objects

ACM Classification
H5.3.

INTRODUCTION
In the field of human computer interaction (HCI) a variety of methods exist which focus on end-users, however these have not yet been applied to the novel organizational form of open source. Current studies of open source systems development and open source organizations fall within three broad categories: usability studies, open source as user driven innovation, and organizational studies. When user involvement in the design process and usability have been studied, the focus has been on how users reports bugs and wishes for new systems features as well as how the development community reacts towards these reports and wishes [1, 2]. Studies of how open source communities are organized focus on the way the community makes decisions and the use of mailing lists as means of communication [3]. In the case of open source communities as *Innovative communities,* [4], the users generally referred to are programmers that alter and program the open source software, and not end-users.

THE TYPO3 CASE
The TYPO3 system is a small to midsize enterprise class content management system (CMS) under an open source license. The CMS is aimed at two different groups: editors and administrators as well as content managers.
TYPO3 has been public in 5 years. It has 320 active contributors. Because of the widespread use, its distributed development process, and variety of users, TYPO3 has introduced a more formal organizational structure with organization committees and various subgroups (see http://typo3.org). The community consists of developers, who do programming of the TYPO3 system and a large part who use TYPO3 to program individual business solutions. In practice, developers may take on both roles.
The R&D group in the TYPO3 community has chosen to address the issue of usability in coming TYPO3 versions, but realized that their "code now, humans later" focus in the community [5] made it difficult for them to attract the knowledge needed to achieve an active involvement in end-user issues.

THE USERS
The community has no common knowledge of who the actual end-users are. A description of target groups list the users broadly, based on organizational intuition. Discussions in the community are often merely referring to users as professionals or newbies, administrators or end-users. When this study began, there was no structured or explicit knowledge about - or interest in - end-users from an operational viewpoint.

END-USER AMBASSADORS
To disseminate knowledge of end-users to the community, a group of TYPO3 developers with particular enthusiasm to

carry out usability work was formed. The objective was to get them to act as ambassadors for usability in coming projects. As part of this process the authors of this paper conducted a pre-study of the use of TYPO3 in two different organizations differing in size, complexity of the system implemented, and the end-users' possibilities for IT support. Four interviews and three observations were made. Talking to end-users and seeing them use the system, provided insights about work, work situations, and attitudes. Attitudes originated in computer skills with end-users being either comfortable with computers thus putting demands to the system or uncomfortable with computers, but pleased with the system as long as fixed procedures were followed.

In a distributed online forum, the usability-group investigated what they knew about their end-users as written descriptions of actual end-users they had met. The developers immediately perceived the request for user descriptions as a request for descriptions of abstract user-types, which they denoted "persona" in their discussions. Taking a solution oriented approach the used personas to describe solutions for the system. Later they were asked to interview their users and four e-mail interviews were carried out. Interviews showed that most end-users were content with the system, but they also exposed a huge variation in the use of the CMS. It is either used by novice users, with a very limited set of functions on a less frequent basis or end-users, with high computer skills, uses a wide range of functionalities on a daily basis. This supports observations made earlier, but interviews were too few to be of any value. The ambassador lacked awareness on usability and even if they found it important, it never became clear to them what the aim of the project was and no more data came out of it. This made us close down the project.

THE HCI MAILING LIST

Parallel to the forming of the usability group a new mailing list, the typo3-team-hci list, was added. The correspondence on the list exposes a frequent inability to cope with engagement in end-user issues other than by implementing rapid solutions to specified problems. Once again engaging in users is seen as a solution oriented problem, since end-users are perceived as solution finding actors.

The mailing list has developed steadily since May and still features a lot of discussions about solutions with a noticeable exception being a forum discussion taking place in late September 2006. A thread started by Kasper Skårhøj whose re-reading of an article [1] instigated the asking of more critical questions about end-users. The thread can be distinguished from others in the HCI-forum since it sought to determine which solutions are better considering end-users and the motivation of developers to solve end-user problems. While posts about specific solutions get more attention in terms of posts, this discussion occasioned a rather extended dialogue consisting of 24 posts from 11 different posters. However, the problem seems to be that discussions lapse towards either specific problems (e.g. correct labeling of functionality), towards paradigmatic observations of a very general nature, or towards ethical paradoxes inherent in open source development – why care about users at all when you do things for free?

BOUNDARY OBJECTS

The objective in launching the HCI group in the TYPO3 community was to bridge the gap between developer and end-user agendas by trying to establish both knowledge and an adequate vocabulary for discussing and understanding the needs of end-users. [6] use the term *boundary object* to describe an object (either material or semiotic) that works within a group to define and coordinate various interests, knowledges, and agendas. The role of boundary objects is to coordinate different kinds of actors or communities and facilitate a common goal. Having ill-defined or vaguely defined boundary objects therefore complicates problem solving and coordination between parties and individual actors.

From the analysis of the discussion we can conclude that establishing users as material and/or semiotic boundary object is essential for an organization learning to deal with end-users. However, we can also conclude that this has not yet happened, and that discussions often start with questions about users, but frequently depart from the original outset and lapse back into developer centered problem solving.

CONCLUSION

The ambassador project and the mailing lists failed to facilitate awareness of end-users. The question now becomes how to facilitate a boundary object/learning situation that sufficiently translates into coordinated action. In further analysis across the discussion and the recently set up TYPO3 HCI *wiki*, we hope to identify translation and vocabulary trouble that seem to lead to problems in articulating a common understanding of end-users.

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Finding the difference which makes a difference: From user profiles to xxx in the FEEDBACK-project

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ABSTRACT
The paper discusses prioritizing forces of context in design of interfaces to walk-up-and-use-systems for un-motivated users. Experiences from working out user profiles and conceptual prototypes in the FEEDBACK-project suggests perceived feedback to be an intersection of cues to answers to What-Who-Where-How-questions: *what* is the state of affairs, *whom* does this state of affair concern, *where* do they accept to be disturbed about this, and *what form* of disturbance is acceptable.

Author Keywords
User-profiles, forces of context, walk-up-and-use interfaces

INTRODUCTION
In design of interfaces it is always a challenge to match form to context of use - the famous 'fit between form and context', by Alexander [1] characterized as 'the quality without a name'. If only it was a matter of investigation and combining sources of knowledge, engineering would be the answer, as suggested by Simon: *'the optimization problem is to find an admissible set of values of the command variables, compatible with the constraints, that maximize the utility function for the given values of the environmental parameters'* [6]. Already choosing the traits, which is held to characterize the context, is however a serious design problem, a 'wicked problem' [2], for which there is no straight forward solution. The designer is referred to make a choice, as informed as possible, without ever knowing if choosing differently would have produced a better fit. In this paper we interpret findings from a concluded phase of an on-going research project, the FEEDACK-project, the aim of which is to give online feedback to households about their electricity consumption. Aalborg University (these authors) is responsible for producing user profiles and conceptual prototypes of user-interfaces. User profiles and conceptual prototypes were produced through a design process driven by innovations from selected end user households [4].

For this short paper we have selected the discussion of our 'informed choices' with respect to which forces of context to take into account when preparing the user profile: At the outset we, based on existing research, focused on user attitudes, and in the end we extended forces of context to also comprise setting and type of information. Accordingly the paper has two sections: Problems with drawing on existing research in choosing forces of context and validating choice of forces of context through instances of user driven innovation.

PROBLEMS WITH DRAWING ON EXISTING RESEARCH IN CHOOSING FORCES OF CONTEXT
The aim of the FEEDBACK-project is to develop and test new concepts for the utilities' communication with households about their electricity consumption at the end-use level (feedback), and to give a scientifically based answer to the question: Does online feedback about electricity consumption generate electricity savings, and will the savings increase, if the feedback is given at the final consumption level (i.e. electricity consumption of the specific appliance) compared to a situation in which it is given as the summary electricity consumption at household level.

According to the project plan user profiles/personas should help all parties in the project focus on user preferences, habits and attitudes throughout the project, and the conceptual prototypes of the feedback interfaces should be designed to fit these profiles. Hence, at the beginning, 'user profiles' was synonymous with 'forces of context' with respect to design choices of the interfaces. In this case, as in case of most public online services, 'users' are everyone, which is why demographic, psychological or sociological segmentation is difficult. Public online services are 'walk-up-and-use-systems' with the twist that the kind of service offered is not requested: users are in no 'need state', but rather in a state of not wanting to know.

We began by consulting a project partner, Aarhus School of Business (John Thogersen and Alice Grønhøj), who suggested to take 'forces' as attitudes referring to research on attitudes towards electricity consumption [5] based on which we generated a typology of four attitude profiles for families/households: 'don't care', 'busy', 'economic' and 'environmentalist'. Based on these attitudes and attitudes towards technical innovation developed through our own case studies [3, 4] we screened families, which we found through snowballing, till we had eight families, who we thought covered the typology, with which we ran the user-driven design workshops in the project. Although we had

good reasons for giving priority to attitude research, we thereby ended up suppressing situational aspects of use, traditionally considered very important within the field of HCI. This would have been a problem with respect to developing valid user profiles, had it not been for the user-driven approach to the design of conceptual prototypes. Being on location, in the homes of the eight families, innovating together, made us see forces of context differently.

VALIDATING CHOICE OF FORCES OF CONTEXT STEMMING FROM INSTANCES OF USER DRIVEN INNOVATION

We conducted seven design-workshops: 1) Initial user profiles and Lab design of a game to help the families focus. 2) Video-documented visits in the homes, where the families played the game and took photos, which they annotated saying what kind of feedback they wanted, and why. 3) Lab analysis of collected material, and design of mock ups and probing kit. 4) Families using the mock ups for a week and returning probes. 5) Lab analysis of probing kits, and design of two innovation workshops with the families. 6) Lab workshops with the families, where they criticized the mock ups, and designed an interface of their own. 7) Lab design of user profiles, and conceptual prototypes of interfaces.

In the final state we revised the user profiles, because we realized what was the feedback as experienced by the families, namely the intersection of information, situation, location and media, below presented under the headings of What, Who, Where and How.

'What' refer to what kind of information 1) Remember!, 2) Monitor, 3) Compared to, 4) More knowledge. Actions like 'turn off the light' or 'check if the TV is still on' are, if not routine, a matter of in-situ prioritizing, hence seeing the information at a glace is important. Planning situations like 'is our freezer too el-consuming - should we change, even though it is still functioning? makes information that puts actual consumption into perspective desirable. If the family decides to buy a new freezer, being able to seek out the least electricity consuming product is important.

'Who' refers to the prioritizes of the 'What'-feedback, a revised version of our initial attitude typology, separating those who give first priority to economy, to more knowledge, to do-good, or to high quality in products and in life in general. In our conceptual prototypes we have tried to meet them all by building a nice, simple, but layered interface on a large clock display.

'Where' refers to the locations in the home, where the families were ready to even consider acting or planning about electricity consumption: For reminder-feedback the kitchen, where also shopping lists are prepared, and the exit door, when you also check to lock etc. was the favorite, and for planning information the kitchen and the home office were the chosen spots.

'How' refers to the degree of pull or push in the form of the feedback. Pull, as in websites you have to look up, was not preferred – they invoke at situation of 'going to the computer and make a search' as an extra effort. This was also the case for pull-technologies as e-mail or sms because of the smell of 'big brother'. Both objections confirmed that this kind of information is not a felt need by the consumers. The families, when designing themselves, came up with small screens, put up on the fridge, at the exit door, or eventually where you have to kill some waiting time – again the kitchen is the place.

Within the frame of research in interaction design we find, that using attitude research from the application domain enriched our design tool box in the beginning, but our way of working with user-driven innovation provided an indispensable test of the golden 'Wodiczko'-question *'How close are we to the ground?'*[7] – which is where the designers' prioritizing of forces of context inevitably rest.

CONCLUSION

We described experiences from prioritizing forces of context in user profiling in the FEEDBACK-project: how attitude research contributed to the initial zooming in, in cases where the traditional walk-up-and-use heuristics are not sufficient, and how user-driven innovation contributes by taking the designers to the real water holes, the difference, which makes a difference.

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Cultural aspects of the Think Aloud Usability Evaluation Method (UEM)

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ABSTRACT
In this short paper, we will focus on the impact of culture on the established Usability Evaluation Methods (UEM). The production and use of technologically advanced information and communication applications is no longer restricted to the Western world. There are indications that usability testing procedures developed for use in e.g. Europe or the US fail to give reliable results in countries such as India, China or Malaysia. The paper discuss results from pilot studies which indicate that different parts of the think aloud usability testing procedure – verbal reminders, gestures and the language used – are important in different regions of the world.

Keywords
Think Aloud, Usability Evaluation Method, Culture.

INTRODUCTION
This paper presents some findings from an investigation of the cultural specifics included in usability test situations in three countries: Denmark, India and China. In each country, we have studied the effect of evaluators' cultural background on the usability testing of a localized clipart application. Everywhere the results showed that the local evaluator, i.e. the local test user relation was most effective in generating think aloud events and identifying culturally specific usability problems. However, each study indicated cultural specifics in the important aspects of running an established think aloud usability test: Reminders were important in the study in Denmark, gestures in the study in India and language in the study in China. We will discuss the implications of these findings for cross cultural research in usability testing methods and for the cultural sensitivity of usability testing procedures.

METHODOLOGY
Our main focus was: to determine whether the usability evaluator almost has to belong to the target culture to fully understand how people will respond to the established UEMs such as the think aloud usability test?

Previous studies on cross cultural usability evaluation show that culture broadly affects the usability evaluation processes [7]. Therefore, it seemed relevant to investigate the assumption that the usability evaluator almost has to belong to the target culture to fully understand how people will respond to the established UEMs such as the think aloud usability test. The classical cognitive account of what it means to think aloud [4] says that there should be very little interaction between a test user and an evaluator during the test. After a task begins, the only interaction allowed is to ask the user to keep thinking aloud. This procedure should give the evaluator the optimal data about the information used by the test user during the task performance. But would this procedure also apply when we used foreign evaluators or test users?

To investigate this question, we compared different combinations of evaluator-test user relations in a simulated think aloud usability test of a localised cultural clipart application, and measured the effects on the think aloud test procedures identifying the usability problems. We repeated this approach in Copenhagen, Guwahati and Beijing.

RESULTS
The major findings from the Copenhagen, Guwahati and Beijing studies are tentative differences in which kind of usability problems local and non-local evaluators identify. The non-local evaluators identified more of the cosmetic (Microsoft Word related) usability problems, while the local evaluators focused on critical (Cultural Clipart related) usability problems. These results support the experience by [3] that there is a need for local usability professionals when the test users are local and the test application is localized in order to identify important usability problems. In addition, we found that reminders, gestures and languages had an effect on the interaction between the evaluator and the test user and the identification of usability problems.

Reminders
In the Copenhagen study, the evaluator's reminders to the test user in the local-local condition were mostly affirmative rather than classical neutral. The local evaluator gave more help to the test user and the local test user was the most active think aloud user. As a result, the local evaluator– local test user pair found the highest number of culturally specific usability problems compared to the other

pairs. The central role of affirmative reminders and the evaluator's helpful behaviour in the experiments support the recent suggestion to adopt the communication theory instead of the information processing theory as the theoretical basis for think aloud usability tests [1].

Gestures

In the Guwahati study, neither classical verbal reminders nor affirmative reminders affected the identification of usability problems. Apparently, the important reminders were non-verbal gestures, which allowed test users to express their thoughts more freely and show their emotions during their work with designing a wedding invitation.

It is possible that the important role of gestures may reflect language difficulties, e.g. the foreign evaluator's English accent might have forced the test user to rely more on gestures to understand the reminders. However, the Indian evaluators seemed to be better able to read the Indian test users gestures which gave them an advantage in assessing the test users usability problems and satisfaction with the test application. Keeping in mind that some participants are shy and others chatty, there are various situations in which the participant may get stuck, and here the evaluator plays an important role to secure a smooth completion of the task. It is the evaluator's responsibility to judge the level of intervention and communication. Furthermore, usability testing requires that the evaluator assesses the test user's satisfaction level, which is a subjective value [6]. Summing up, the evaluator with local experience and knowledge has the advantage of being able to read the non-verbal cues of the test user.

Languages

In the Beijing study, it made a difference on the evaluators' behavior whether he/she spoke English or Chinese. If the evaluator spoke Chinese, he/she was more inclined to help and provide a more detailed instruction. If the English language was used, the evaluator and the user looked at each other more frequently to ensure there was no misunderstanding between them.

Furthermore, the English speaking evaluator had to ask the users directly to report on their thoughts related to obvious usability problems that the users found in the cultural clipart folder. In the subsequent interview, many users said they had noticed some culturally wrong symbols among the images and icons, but they did not manage to mention them until the evaluator asked them to pick them out. This supports the observation that asking the Chinese test users to say their thoughts out loud might have a detrimental effect on their ability to work on the task [5].

However, the findings may also be interpreted in the light of a study on usability testing in Malaysia, which showed that if a test user has a higher rank than the evaluator, it will result in more negative comments about the product than if a test user has a lower rank than the evaluator [7].

DISCUSSION

In international usability evaluation, the principles of user-centered design are simply extended to an international context, and the issues involved are considered trade-offs such as where to go to do the empirical usability study, how to find and contract with local resources, how to recruit local users in an adequate way and adapt the test plan, how to train local evaluators, how to get reports translated and whether to do studies in many countries in parallel or in serial [3].

In our study, we were not able to answer or study all these trade-off questions. Since our study indicates that the evaluator's reminder behavior during the think aloud usability test session showed significant effects of belonging to the target culture, we may question the whole idea of simply extending the principles of user-centered design to an international context.

For example, a usability company may develop a certain standard for international usability evaluation, which promises that the company will "…develop a suitable test protocol in cooperation with the customer…and supervise standard think-aloud usability tests for each of the six test participants in each of the countries…..conducted in the local language by a native, local usability expert…[selected on basis of] their demonstrated knowledge in the field" [2].

A number of findings from the experiments have led us to doubt if such a standard is universally applicable. However, more research is needed to qualify the insights into cultural aspects of the Think Aloud Usability Evaluation Method.

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Interaction Design and Spatial Experiences

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ABSTRACT
IT is rapidly spreading to non-desktop environments, and is increasingly being used for post-functional purposes. Recent contributions within the field of interaction design have indicated a tight coupling between physico-spatial and experiential issues, both on a technological and on a theoretical level. However, interaction design and HCI yet has little to offer designers working with physico-spatial and experiential issues in practical design cases.

In this paper, I argue that experiments that explore spatial and experiential aspects are crucial in developing the practice of interaction design. These aspects may be brought to the forefront by engaging in, reflecting upon, and reporting from physico-spatial design experiments, and by making spatial and experience-oriented design representations part of the design process. These experiments may be supported by design representations inspired by the field of architecture.

Author Keywords
Experience Design, Interaction Design, Space, Experience.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION AND BACKGROUND

Many IT designers are now engaged in designing what Winograd [6] has dubbed inter*spaces*, assemblages of interfaces, actors and environments. Pervasive computing has prompted an increased interest in physical dimensions of interaction, and IT increasingly populates domains outside of the workplace and take on forms that may be dubbed *post-functional* in that they are conceived as much more than task-oriented means to an end. Several recent contributions to the field of interaction design, such as Dourish' [2] and McCullough's [4] parallel work on embodied interaction and embodied predispositions, have highlighted the intimate relations between physico-spatial and experiential aspects of IT-mediated interaction.

The paper is borne out of experiences from working with this type experience-oriented interspace design with various non-academic partners such as museums in the project "*Experience-oriented applications of digital technologies for marketing and knowledge dissemination*". In carrying out this work, it has become apparent that the fields of HCI and interaction design offer few contributions for designers struggling with physico-spatial and experiential issues in real-life design processes. As an example, Activity Theory [1], a prominent framework within HCI, emphasizes the importance of space in interaction. Activity Theory however addresses spatial issues not in the design process, but primarily in domain studies prior to the design of information systems, or after the systems have been introduced into the domain. Furthermore, it is not developed to address issues of experiential qualities in interactive systems. However suited Activity Theory is for understanding and analyzing assemblages of space, artifacts and actors in interaction, interaction designers are in need of expansions or supplements that will aid them in their work with physico-spatial and experiential issues in the design process.

This is obviously problematic for interaction designers: spatial and experiential issues do not resolve themselves, and it must at least in part be the responsibility of conscientious interaction designers to contribute to the configuration of the environment of interspaces as well as that of interfaces. Based in Schön's [5] notion of the design process as a dialogue between the design situation and the reflective designer drawing upon a repertoire of knowledge, I argue that design experiments are key to exploring these issues and gaining insights into physico-spatial and experiential design issues. Furthermore, I argue that interaction designers may seek inspiration from the field of architecture in using various design representations to address physico-spatial aspects in the design process.

DESIGN PRACTICE AS A CATALYST FOR INSIGHTS INTO PHYSICO-SPATIAL AND EXPERIENTIAL ISSUES

One approach to better understanding physico-spatial issues is for interaction designers to reflect upon and create rich descriptions of the spatial design experiments that lead to pervasive computing systems. These experiments are often black-boxed in accounts of information systems, such as those in HCI journals and proceedings, which focus rather on descriptions of the domain before the introduction of a system, of the properties of the system, and of the domain after the introduction of the system.

As pointed out by Schön [5], design is a continuous dialogue between the designer and the situation, and there are valuable lessons to be learnt from this dialogue. Primarily, the designer in the situation may gain new insights and expand his/her repertoire by reflecting upon the situation. However, practitioners who did not partake in the experiments but have access to accounts of them can also benefit, both by analyzing case studies and by looking into and discussing the reflections of the experimentors.

I thus make the case that for a richer understanding of physico-spatial and experiential issues 1) interaction designers and researchers should engage in, reflect upon and create rich descriptions of physico-spatial and experiential experiments, thus using the design process as a catalyst for research, and 2) that accounts of these experiments, in addition to descriptions of resulting products and systems, should be presented in interaction design papers and articles.

Two reasons for making these arguments, straightforward as they may seem, is that the tendency to leave out accounts of the design process may on the one hand cause designers to neglect the reflection process, and on the other hand may cause other practitioners to engage in the very same experiments without knowing of the insights already gained by their peers. Furthermore, insights from design experiments may inform analyses of spatial and experiential issues prior to and after the introduction of pervasive computing systems.

Spatial design representations

The primary interaction design material, IT, has widely been construed as non-physical and temporal. However, when designing spatial interfaces, physical materials come into play and designers must understand how the properties of IT relate to spatial properties and boundaries as design materials. Architecture concerns the organization of activities and social relations by means of spatial layout [3], and it thus seems a highly relevant source of inspiration for interspace designers. As a concrete way of seeking inspiration from architecture in the design process, we suggest that interspace designers work with various spatial design representations thoughout the design process. Within the field of architecture, the design process is continuously manifested in models and representations. These physical and digital representations are an embodiment of the design process, where alternative designs and design decisions are represented in different forms. Prototypes in interaction design traditionally demonstrate and explore interaction with a focus on functionality, whereas models in architecture can serve to provide visual overviews and understandings of the entire space in which spatial forms and users will co-exist in the performance of activities.

Architecturally inspired design representations can take on a number of forms – eg. small-scale interspace models, static paper sketches, statistically informed renderings of user behaviour, collages of domain photos combined with artistically charged imagery, dynamic and interactive 3D simulations etc. – and may capture and represent structural, instrumental aspects as well as aesthetic and affective ones. Physico-spatial design representations may expand the functional focus of traditional prototypes and serve as vehicles for communication, exploration, and understanding. As such, these representations supplement not only prototypes, but also design representations such as mock-ups, storyboards, scenarios etc.

CONCLUSIONS AND FUTURE WORK

This brief paper outlines the need for interaction design researchers to carry out, reflect upon and create rich accounts of physico-spatial and experiential experiments in their interaction design practices, possibly involving spatial design representations. As part of my future work in my PhD project, I plan on doing just that, hopefully resulting in 1) a framework for understanding spatially situated experiences with interactive systems and 2) guidelines and methods for use in the design of such systems.

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Designing Spatial Multi-User Interaction

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ABSTRACT
In this paper, the Spatial multi-user interaction design program is presented as a part of a PhD research program [1]. The overall focus is to explore the possibilities of spatial multi-user interaction and how this can be designed. The program consists of the theoretical foundation based on HCI and action oriented interaction design. The experimental design model consists of four design spaces which can be used for information gathering and prototyping and is basically a design, inspiration and discussion tool for interdisciplinary designers.

Author Keywords
Interaction design, spatial multi-user interaction, design.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Hallnäs et al claim the need for new design programs that can guide and develop practice by opening up new design spaces, and define a design program as a general description of the design intention, where some position regarding basic approach is stated [2]. The design space that is identified and explored in this program is spatial multi-user interaction. In the following sections the general program theme and basic motivations for spatial multi-user interaction will be described, followed by a design model used in design experiments.

The design program has implicitly been the base for design experiments, and the design experiments have explicitly been the foundation for further development of the design program. In future work, the design program will be the foundation for further experiments.

Spatial multi-user interaction refers to the design of computational things with a strong focus on several simultaneous users and spatial aspects, and where a focus on spatial aspects is a central design variable. The central theme is interaction design with a clear focus on the appearance of physicality and several simultaneous users rather than design for efficient use with its focus on digital aspects and single users. It is a program that extends the traditional work practice based HCI into playful and leisure based interaction design.

Spatial multi-user interaction supports human communication through computational technology based on democratic values, where several simultaneous users do not have to take turn in being in control and where interaction is based on movements of the human body. As opposed to work practice based technology designed for efficiency, this is technology where the human body in physical space is in focus for playful and leisure based interaction.

Spatial multi-user interaction takes a start in people's way of expressing themselves physically, both individually and together with others. Here, the human body with its multiple intelligences is a given, and the computational things attempt to be designed within the limits of the human body's expression. To support the user in several of her intelligences by exploring both the physical, digital, social and interaction space, is taking advantage of the materials potential to a great extent.

A designer can discover new design potentials in the existing environment when being in a design situation. A user can re-discover a familiar thing as it suddenly has the potential to perform new things. The interaction comes from human behaviour, and the tools are familiar with built-in technology, which are conscious design intentions, namely that the object has been designed to support the user by explorations in this technology's – this material's – properties, and not changing the user's behaviour.

Basic motivations

As a program for experimental design, Spatial multi-user interaction is concerned with the dual design introduced by computational technology. The basic characteristics of computational things are in their appearance in use, their expressiveness, dependency on the execution of programs and its manifestation in a physical material. Design of computational things thus necessarily involves components of spatiality; questions about working models for a design practice where the digital and physical aspects and computational technology as a design material are central issues. This motivates experimental work where special attention is paid to spatiality as a basic design parameter.

DESIGN MODEL: SPATIAL MULTI-USER INTERACTION

A challenge within pervasive and ubiquitous computing is to design spaces where people can live, communicate and interact without the technology interfering. To have the environment support human behaviour to such extent that we act without paying that much attention to what we do. This PhD-project approach this challenge by examines spatial multi-user interaction, spaces where several persons spatially can interact and communicate simultaneously. Four factors have been identified to be able to focus on and define spatial multi-user interaction, and they are named *space* in the sense of potential design spaces:

- *The interaction space*: The sensor reading space where movement, fix points and inputs can be sensed
- *The social space*: Where humans act and live their everyday lives, communicate, co-operate, attention, activity, intention, understanding, place
- *The physical space*: Everything visible, meaning things, environment, personal gadgets, appearance, location, physical interaction, physical time/space
- *The digital space*: Projections, communication protocols, computer model, infrastructure, relative time/space, augmented space, machine communication

These four spaces have been chosen as they complement each other in covering the context of a computational thing. The four spaces have successfully been used in different projects, and have proven helpful for designers.

DISCUSSION ON THE DESIGN MODEL

The model presented above is a try to divide the findings and the prototypes into different design spaces. The model can be used as a tool in the data collection phase, in the design phase, for definitions and in discussions. The model is a try to mark out that all the four design spaces are equally important when designing computational things, and especially for spatial multi-user systems. Working with information technology as a material for design means working with software, hardware, traditional physical materials and social aspects. The model aims at making this fact more visible during the entire design process.

To develop inter-spaces where people live, communicate and interact simultaneously, without technology interfering with human behaviour, the four design spaces could be a help to investigate how to design the system, not the user. An analysis of the four spaces can be the foundation for developing spatial multi-user systems, and thereby support human behaviour in both the physical and digital world.

It is important to manifest that there is no exact way of drawing a clear distinction to what is one or the other. They are all important aspects, and they all both demarcate, intervene, mix with and relate to each other. By actively taking a decision upon where to place an aspect can give rise to very fruitful discussions. Depending on the background of the designers and their individual interpretation of findings will have a huge impact on design. This fact can create very interesting discussions, and could be an eye-opener to the design team. As interaction design is an interdisciplinary field, with several different competences, people come to have very different opinions about what finding is relevant in which category, and the impact of it in other categories. Competences involved in this project are interaction designers, architects, engineers and computer scientist, and there is a constant very fruitful discussion about what is physical or digital, what approach to have in design, and so on.

To further explore the possibilities of combining the four design spaces in designing spatial multi-user interaction, spatial architectural perspectives can be included to enrich the interaction design. By focusing on and understanding information technology in combination with spatial properties and boundaries as design materials is to take advantage of what is already in the context, however the nature of a design material is its ability to take up new forms or relate to other materials in new ways shifting its initial function. The focus on these aspects provides designers the basis to rethink the existing elements of the context – the physical as well as virtual elements.

CONCLUSION

Interaction design is an unfolding activity demanding deep involvement from the designer. Sometimes the designers are not aware of what materials there are in a design situation, or different materials mean different things to the different designers. The design model and the design methods presented in this experimental design program can be one way of engaging the designer in unfolding the context and materials at hand. Hopefully, spatial multi-user interaction is a growing area of interest in interaction design, to meet with the user in the physical world and take a start in people's way of expressing themselves physically. This design program claim for weighting the aspects from the physical design space equal to aspects from the digital, the interaction and the social design space.

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The USE Project: Experience with Usability Evaluation Techniques in Software Development Organizations

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ABSTRACT

This paper provides experience from activities in the USE project. The USE project is a research project that aims at bridging the gap between usability evaluation and user interface design. It is conducted from 2005 to 2008 in collaboration between researchers from Aalborg University and Copenhagen University, and developers and managers working in software development organizations.

INTRODUCTION

Despite more than 20 years of research into usability engineering, there is still a significant gap between usability evaluation and user interface design. An increasing number of development projects employ usability engineering techniques in an attempt to improve the quality of the software produced. While these evaluations often help identifying extensive amounts of usability problems, they typically have a very limited impact on the related design and development activities (Hornbæk and Stage, 2006).

This paper provides experience from experiments with new techniques for usability evaluation and alternative forms of feedback from usability evaluation to user interface design. The results presented here have been obtained during the first two years of the USE project. The presentation of some activities includes references to publications while others are being written up.

EXPERIMENTS IN COMPANIES

The key activity in the USE project is experiments in the four software development organizations that participate. During 2005 and 2006, the experiments have been focused on in-depth studies of *real usability work,* on *techniques for generating feedback* from usability evaluations and on *developing and validating evaluation methods*.

Real Usability Work

Two experiments on *real usability work* have primarily aimed to characterize how companies work with usability in realistic circumstances. The first experiment proceeded from the observation that even though think-aloud testing is widely employed, its use in practice is rarely studied. We conducted an explorative study of 14 think-aloud sessions. The study showed that immediate analysis of observations was done only sporadically and that evaluators seem to seek confirmation of problems that they are already aware of. For example, during a test evaluators would ask users about their expectations and about hypothetical situations, rather than about experienced problems (Nørgaard and Hornbæk, 2006).

The second experiment specifically targeted usability specialists' reactions to a particular product and investigated how usability professionals work when evaluating web applications. Thirteen teams of professionals evaluated a web-based design tool and each team prepared an evaluation report. These reports were analyzed and discussed.

Techniques for Generating Feedback

We have conducted four experiments with feedback from usability evaluation to user interface design. The first of these examined how developers of a large web application assess usability problems and redesign proposals as input to their systems development. Developers assessed redesign proposals to have higher utility in their work than usability problems. The redesign proposals gave them new ideas for tackling well-known problems, and the redesign proposals were seen as constructive and concrete input (Hornbæk & Frøkjær, 2005).

The second experiment studied developers' reactions to different forms of feedback from usability evaluations. Software from two development projects was subjected to think aloud tests, and videos of the tests were analyzed. The results of the tests were presented to the development teams in two ways: one team received the traditional usability evaluation report and the other team multimedia feedback during a feedback meeting. The developers like the detail of the full report, but that they would prefer to only have the great detail for the specific parts they work with.

The third experiment studied presentation of feedback from a usability test using five feedback formats. The developers assessed the feedback, and after working with it for three months they redid the assessment. Before working with the feedback, developers rated redesign proposals, multimedia reports, and annotated screen dumps as more valuable than a list of problems, which was rated more valuable than a scenario type format. After working with the feedback, developers rated the value of formats alike.

The fourth experiment concerned developers' knowledge of usability problems in the software they develop. The developers of two comparable software systems participated. They wrote down all known usability problems in the software they developed. Afterwards the two systems were usability tested with users, and the results from the evaluations were compared to the usability problems described by the developers. The results indicate that the developers know some of the usability problems in the software, but the results from the usability evaluations add further knowledge and specify what the developers have only a general idea of (Høegh, 2006).

Developing and Validating Evaluation Methods

Three experiments on *developing and validating evaluation methods* take various directions. The first experiment noted that recent criticism of think-aloud testing (TA) has discussed discrepancies between theory and practice, the artificiality of the test situation, and inconsistencies in the evaluators' interpretation of the process. To overcome these criticisms, we describe Cooperative Usability Testing (CUT), where test users and evaluators join expertise to understand usability problems. In a comparison of CUT to TA, seven evaluators found that interpretation sessions contribute important usability information compared to TA. Also test users found participation in the interpretation session interesting (Frøkjær and Hornbæk, 2005).

The second experiment compared Concurrent Think-Aloud and Retrospective Think-Aloud, in particular their ability to facilitate verbalization in a sensitive setting. During testing in realistic settings, some information might be unsuitable to verbalize, either due to the personal or private nature of the information (medical, personal data, etc.) or due to an inappropriate disturbance of the surroundings (libraries, meetings). This was studied in an evaluation of an application aimed at supporting home health care workers in their daily work. The tasks were designed to reflect the daily work of the participants while at the same time contain both personal and private information.

The third experiment concerned identification of usability problems. This experiment examined to what extent a conceptual tool can support problem identification in a usability evaluation. Two groups of novice evaluators participated; one of the groups had received a conceptual tool and a related presentation. Both groups conducted a usability evaluation based on the same recording of a user applying a web-based system to solve a series of tasks. The experiment indicated that the conceptual tool and training in using the tool improved identification performance of a group of inexperienced usability evaluators (Skov and Stage, 2005).

NEW ACTIVITIES

A new research activity is aimed at understanding how key persons in industrial software development project are working with usability, how they perceive usability, and how their perceptions impact the quality of the software. Five companies are involved in the activity, with key persons covering the roles of users, customer decision makers, software developers, and project leaders.

A different activity involves a company that we have recently started collaboration with. The purpose is to improve the company's interaction design through introduction of specific usability evaluation techniques. We have conducted a usability evaluation of one of their products and we are planning how to proceed.

CONCLUSION

We have described activities in the USE project and some of the results we have obtained during the first two years. The main goal of the project is to deliver a catalogue of techniques and tools for usability evaluation and feedback with measures of impact on design that are empirically validated in industrial settings The work exemplified above is the first step towards these goals and support better integration of usability evaluation in software development.

ACKNOWLEDGMENTS

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Pervasive Mashups

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ABSTRACT
The paper presents pervasive mashups as a new view on the design of ubiquitous computing systems. Inspired by web services mashups, the mashup approach highlights how ubiquitous and pervasive systems are often created by combining, squeezing and mashing different components together. But not only are these systems created by mashing different technical components together. Pervasive Mashups are equally created by mashing these technical components together with the existing physical space, its affordances and constraints, and the multiple activities already taking part within the space.

INTRODUCTION
Designing technologies for non-desktop settings are challenging. Davies et al point to the difficulties in moving from designing desktop programs to ubiquitous systems: "Today, building ubicomp systems for realistic scenarios is difficult. Compared to simpler, more mature interface domains, development tools and methods are still at an early stage, and development is expensive, significantly hindering our progress" [4]. The quote highlights the need for the development of tools and methods tailored for pervasive and ubiquitous computing. In this paper I will present the notion of pervasive mashups as an approach to the design of pervasive systems.

Mashups
The word mashup origin within a Disk Jockey (DJ) culture and describe the practice of mixing tracks from different songs together to create a completely new song. For instance by taking the vocal track from one song, mixing it with the drums from another song and finally adding other instruments from a third song, the result is a completely new song based on the previous three. These mashups present a way of allowing artists to reuse each other's material.

Recently, the mashup term has migrated into web design. Within web design a mashup is a novel internet service composed by a number of other web based services and large companies already offer substantial amount of services for use in mashups (Google, BBC, Yahoo, Flickr, Delicious, Amazon). For instance a real-estate photo service can be created by combining a map service and a real-estate service to display pictures taken in the neighborhood surrounding a vacant estate (a list of developed mashups can be found at [8]).

Similar trends can be observed in a number of other areas e.g. within software development with the open source movement and within business innovation with concepts such as open innovation [3].

The mashup term moves the focus away from creating standalone systems from scratch and emphasis instead how systems are designed by taking some already existing elements and combining them to something new or converting, crushing and grinding the elements together. It is not a passive act of putting things together, but a highly engaged activity where the elements requires mashing and squeezing to finally get them to fit together in a new form. And what is important is also that the elements used will often be elements created by others, which are controlled and own by them.

In this paper I will briefly argue that mashups is a strong concept for describing the design of ubiquitous computing systems, but also point out that the term need to be extended to match the complexity of the task of designing for a ubiquitous computing setting.

Pervasive Mashups
Moving from web mashups to pervasive mashups the complexity greatly increases. Pervasive systems differ from desktop applications in at least three areas. They often involve distributed systems running on multiple devices and with multiple users, they are often integrated into the environment and the physical space and they are designed to support novel types of activities not associated with sitting at a desk. Bertelsen and Bødker describe how interaction with pervasive technology seldom occurs with one application or device, but involves the interaction through clusters of artifacts [2] and a similar observation is made by Bardram and Bossen [1]. Mark points to how new metaphors and tools are needed to help people interact with computation invisibly embedded in space [6]. And Redström argues for the insufficiency of traditional human-computer interaction techniques in supporting non-work, non-efficiency activities [7].

Some of the factors influencing the design of pervasive systems are presented in Figure 1.

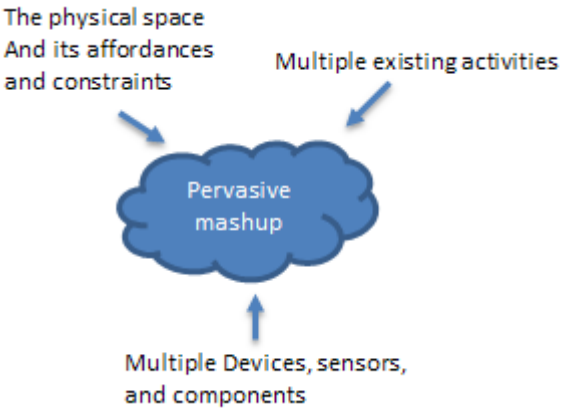

Figure 1 Designing a pervasive mashup focuses on mashing technological components, physical spaces and existing well-established activities together.

Building pervasive mashup is hence not only a question about combining different technological components, but as much a question about mashing up software components, multiple devices and sensor components, with a physical space and a complex web of already existing and well-defined activities. Designing this type of mashup requires indeed a number of new methods, tools, frameworks and prototype examples of how to build these kinds of systems.

A number of research initiatives are already working on building frameworks for building easy to reuse building blocks for pervasive and ubiquitous computing and while this paper will not discuss these initiatives, a short discussion can be found in [5]. Despite the progress, most pervasive systems are still developed from scratch by technology experts.

The physical space is one of the main concerns for architects and industrial designers, but the role of space in interaction design has until recently received little attention. "Physical space rarely matters in current human-computer interaction; but as computational devices becomes part of the furniture, walls, and clothing, physical space becomes a necessary consideration" states Mark and points to the need for considering the physical space within pervasive interaction [6].

Finally, pervasive systems are often used in complex work or social situations and understanding the role of technology in these settings are always challenging. While understanding the *use* of technology has been a central research theme within "Computer Support Collaborative Work" (CSCW) and "Participatory Design" (PD) for decades, a number of new challenges arise when the technology is used to support other activities than work e.g. in creating experiences or supporting social interaction or if the interaction with technology is not a foreground activity, but an activity taking place in the context of other non-technological activities e.g. to support surgery work.

CONCLUSION

The notion of pervasive mashup is presented to move the design focus towards the process of mashing up systems, reusing existing technologies and infrastructures, and designing for future reuse. But not only is pervasive mashups about mashing up technological components, it is as much about mashing up the technological components with the physical space and its affordances and constraints and the multiple activities already part of the space. Designing pervasive mashup is hence not only a technical challenge, but a complex physical-socio-technical-political task.

The aim of this paper is to introduce the notion and further discussions of pervasive mashup and how to design pervasive interaction for complex work environment can be found in [5].

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A Framework for Evaluating Mobile Applications: Capturing Context and Use Patterns in the Field

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ABSTRACT
This paper presents and discusses a test framework for conducting remote usability evaluation of mobile applications in the field by capturing context and usage data in mobile terminals. It is part of an ongoing PhD study where the aim is to develop a framework and new methods that enable more effective and efficient field evaluations of mobile systems.

Keywords
Mobile HCI, mobile applications, mobile interaction, usability, field trials, automated usability testing, test framework.

INTRODUCTION

The future is mobile and wireless. Paradigms such as ubiquitous computing and personal networks are believed to be the near-future solutions for our everyday computing needs - essentially giving access to any information, anywhere at any time. User mobility is a key element in this vision and an increasing number of users will go about their everyday life using applications and services on mobile terminals to fulfill their computing and networking needs while on the move. Our ability to design and evaluate such mobile systems is crucial to their success.

EVALUATING MOBILE APPLICATIONS

Usability evaluation is traditionally performed in a laboratory setting with a high level of experiment control and easy data collection compared to field studies. This practice has been carried on to evaluation of mobile systems as well. In fact a thorough review of recent HCI publications has shown that a very small part of all conducted usability experiments within mobile HCI research is being done in the field [2]. Considering the differences in standard PC interaction and the way users interact with mobile systems this does not make sense.

Mobile Interaction

Even though mobile devices tend to get smaller and more powerful they are still inherently limited compared to normal desktop PCs. The devices themselves and the way they are being used make the study of interaction with mobile applications a very complex matter:

- Devices are smaller with less capacity and limited and often awkward input and output.
- The context of use may vary greatly, often making the interaction a secondary task while the user is busy doing something else. Interruptions and distractions during use must be expected.
- The Environment is highly dynamic and unpredictable. Noise, Lighting and other physical conditions affecting the interaction with the application.
- Network connectivity and quality of service will fluctuate thus affecting the user's experience.

User experiments for mobile applications

Ideally such applications should be tested under the circumstances they are expected to work under. One approach has been to construct special labs for simulating the aforementioned aspects, where mobility and the "stress factors" are artificially created e.g. like [4]. Another approach is to capture the user experience "in the wild" basically moving the usability lab out in the real environment as has been done in [3]. Although decent results have been produced by both methods it can be argued that both these approaches are inherently flawed in the sense that they interfere with the experiment by researchers physically being there and/or not exactly recreating a natural interaction situation. Also it seems difficult to design a test setting that covers all thinkable situations in a complex domain – you might end up finding at most what you are looking for. Problem is that field evaluations are so difficult and costly and [3] rightfully questions if it is really worth the hassle.

This particular study is based on the belief/assumption that some applications are best tested in their natural environment, and that the development of more effective and efficient methods may overcome the shortcomings of doing field trials.

Existing work

Many frameworks and tools have been made to partially automate evaluation, but none of these use the combination of context and application usage data as proposed here [1]. Also they are not specially designed for mobile interaction.

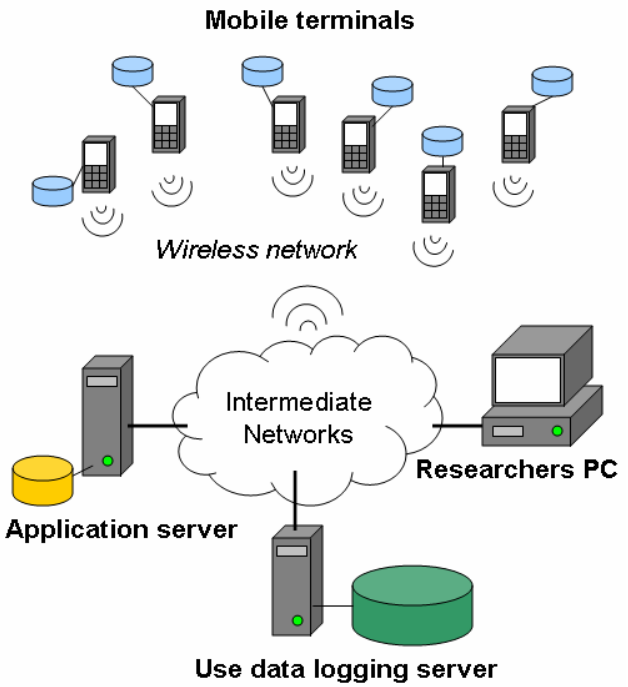

Figure 1. Example setup of the envisioned framework with six persons using a mobile client-server application. Data is logged in the mobile terminals (blue) and at the server side(yellow). All usage data and context is merged in the central (green) database which can be mined by the researcher

THE ENVISIONED FRAMEWORK

The key idea is that the framework should automate some of the very resource consuming parts of user studies, namely data collection. Figure 1 shows the envisioned framework. The data capture should be done in an unobtrusive way and a scheme for reporting and merging data to a central server is needed.

The idea is that the users should freely use the prototype application in their everyday life for a period of time, and the framework will automatically generate a database of interrelated contextual and use related data. Thus there will be no researchers or cameras present and hopefully a more natural interaction can be achieved. The longitudinal aspect of the study could also provide insights that shorter experiments might not reveal.

Capturing data

The key issues are to find out exactly what sorts of data can be used to evaluate the user experience, and to ensure that this data is consistently collected throughout the field trial. The proposed idea is to consider a combination of use data internally in the application (user choices and low-level GUI events like button clicks, time spent in each window etc.), and the contextual data available from the device itself (network status, position, other devices in range, CPU load, etc.).

Systematically gathering such data can then be used for constructing models and use patterns for identifying problems in both the application and the user interface. The availability of contextual data allows the researcher to conclude on usability aspects related to the context of use as well.

By automating the data collection and reporting it will be possible for even a single researcher to do relatively large experiments with many users over large periods of time. If data is continuously collected from the devices over the period the researcher may even start to work on early data to spot promising tendencies or to prepare interviews and questionnaires for the test participants.

DISCUSSION

An idealized list of differences between the current practice and the envisioned practice is shown in Table 1.

Aspect	Current	Envisioned
Participants	Few(5-10)	Many(30+)
Duration	Short(hours)	Long(weeks)
Setting	Lab	Field
Environment	Artificial	Natural
Tasks	Scripted	Natural

Table 1. Comparison of current and envisioned practices

This approach suffers from the standard issues of privacy and security when doing remote monitoring, which have to be overcome. However, the major technical hurdle lies in the collection of data in the device – especially context information. The diversity of mobile terminals and operating systems will also make it very hard to do this in a generic way.

The collected data is very quantitatively oriented and missing a lot of the qualitative feed-back from the users themselves that are collected during e.g. think-aloud tests. Also it is only applicable when a sufficiently high level prototype is available. Thus this new method should be considered complimentary to normal studies.

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Exploring the History of User Interfaces - The Myth of Xerox PARC and other Oddities

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ABSTRACT
In recent years I've become interested in the history of user interfaces, primarily because very little it known about this. In exploring the field, a number of oddities have emerged, the most striking being the myth of Xerox PARC: the graphical interface was invented at PARC. Historians and even Alan Kay, a key figure at PARC, state that this is not the case. This paper first presents this myth, then motivates my work on user interface history, next reflects on various facets of working as a historian and finally presents a few other oddities.

Author Keywords
History of User Interfaces, Myths.

ACM Classification Keywords
K2 History of Computing

INTRODUCTION: THE MYTH OF XEROX PARC

In recent years I've become interested in the history of user interfaces to computers. So far I've explored the area – there are some sources on this topic but not many [6]. In spite of the sparsity, there are some generally held beliefs, one of them being that the graphical user interface was invented at Xerox PARC in the 1970s when Smalltalk, Bravo, Alto, Star, and Dynabook etc. were developed. An example is *"Every time you click a mouse on an icon or open overlapping windows ... you are using technology invented at PARC."* [7, p. xxv]. It seems also to be generally acknowledged that Alan Kay was a key figure: *"He [Alan Kay] .... is also considered by some as the architect of the modern windowing graphical user interface (GUI)."* [13].

However, historian of technology Paul Cerruzzi talks about the "myth of Xerox PARC": *"The elevation of Xerox PARC's role is part of what I call creation of myth for the history of modern computing."* [3, p. 53]. According to the historian, Xerox PARC did not invent the GUI, they furthered ideas from the 1960s. Indeed, Alan Kay, the protagonist himself, stated recently *"PARC is incorrectly credited with having invented the GUI. Of course, there were GUIs in the 60s."* [9, p. 29]. This is an example of the oddities[1] popping up when digging into the area.

[1] Please note that my intention with this opening is to point to a historical anomaly, not to downplay the importance of the excellent work done at Xerox PARC.

WHY STUDY THE HISTORY OF USER INTERFACES?

Apart from my personal motivation, there are numerous reasons for studying the history of user interfaces. First and foremost, having complete knowledge is legion: a key endavour of science is exploring and mapping unchartered territory. In general, in order to understand the present we must understand the past - and more specificly, by knowing the past we can avoid repetition of previous mistakes. The general level of knowledge seems limited. Indeed, an informal survey amongst students at the IT University of Copenhagen re. the history of computers and interfaces suggest that their history starts unanimously with the pc and the graphical user interface.

Secondly, other related fields have since long documented their history. Numerous accounts of the history of computers and computing exist, written initially by pioneers, e.g. [5], and later historians, e.g. [2]. The history of the neighboring field Human Factors and Ergonomics has also appeared [10].

Finally, the meaning of the term user interface has changed considerably, see for example: *"We become part of the interface or rather we bring the interface with us everywhere, we create practices around the interface"*. [4, p. 88]. In conclusion, I find the time is ripe to start to address the history of user interfaces.

TOWARDS A HISTORIAN OF TECHNOLOGY

In this historical exploration of user interfaces, I'm trotting in the footsteps of historians of technology. In October 2006 I participated in the Annual SHOT Conference (Society of History of Technology) in Las Vegas. This is the premiere conference in the field, attracting about 300 participants. The themes were broad, but with a fair amount of IT-related papers, including two sessions on video games. It was very useful to get acquainted with historians' verbal discourse. I learned that most of the historians read their papers from a manuscript and very few had visual support. When questioned about this, the following reason is given: details matter for historians – such as footnotes - so the precise wording is considered important. Indeed, historians' papers are full of end- and footnotes. However, these were not read in the oral presentations! Another indication of the oral tradition is absence of printed conference proceedings - not even abstracts were available.

In my research fields so far (HCI, computer science, and psychology), there is a strong emphasis on methods and methodology. Hence, I have asked many technology historians about a classical book on historical method. "Doesn't exist!" was the unqualified answer. However, I did not give up and at the recent SHOT conference I had a hit: Schafer's book [11].

Historical work is - contrasting all my earlier, empirical work - based on sources. I can't run an empirical study in order to create the basis for answering a research question. Sources are legion and there is a vast amount of *possible* sources - such as books on office automation from the mid-1950s - it is like finding a needle in a haystack.

Historians distinguish sharply between two schools: internalism/presentism and externalism. In the first school, pioneers report their personal experiences, focussing typically on the technology itself. Herbert Goldstine is an example [5]. The second school, externalism, aims at explaining the development of society by addressing the role of technology. This is typically done by people external to the field being studied – i.e., proper historians. My writings so far such as "*From calculation to culture – A brief history of the computer as interface*" [8] have been internalistic – but I'm trying to pick up the practices of historians.

MY RESEARCH FOCUS

Given this lie of the land, the reader may well ask what my research focus is? My current overall preliminary research goal is: The user interface pioneers are well known, but they became pioneers against a background: the mainstream development of mainstream user interfaces to mainstream software used in mainstream organisations. My overall goal is to characterize that mainstream arena and investigate its constituting factors, thereby creating a background for a richer understanding of the pioneering efforts.

ANOTHER ODDITY

Space does not allow me to go deeper into the field, but let me conclude with a few other oddities. Herbert Simon published the paper *Reflections on time sharing from a user's point of view* in 1966 [12]. By then, time sharing systems were gaining foothold. In spite of their potential to bring computer power closer to the user, they also introduced new problems: highly variable and often long response times. Based on an analysis of the user's and the computer's processing capacities and swap times, Simon proposed the user be given two options in time-sharing 1) operating in conversational mode with immediate feedback and 2) operating with a 10-20 minutes turn-around time. Indeed, this may be considered odd today, but the proposed 10-20 minutes periods allowed the users to engage in and *complete* other tasks before returning to the computer.

POSTSCRIPT

Let me conclude this paper by an emblematic statement by Franz Alt, the earliest comment on user interfaces I have found so far [1]. It is from 1951: "*The input and output organs have received less attention from designers than any other machine element. Consequently they are in a rudimentary stage.".*

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Mobility at a Medical Ward: design challenges and decisions for an m-learning application

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ABSTRACT
The paper reports from the MINI-project in which the authors are currently designing a mobile e-learning service for physicians in clinical training. The paper presents results from the analysis trying to grasp what mobility means in this specific context and which design challenges and decisions have been made on this basis.

Author Keywords
Mobility, medical ward, m-learning, design requirements.

INTRODUCTION

During their first years of medical practice physicians need to operationalize their knowledge from medical studies, in the terms of Dreyfus & Dreyfus going from knowing that to knowing how in stages from novice to competent [1]. Even as novices in practical ward the physicians often work alone with patients, analysis of results, diagnosis, and initial care decisions. For learning support their pockets are stuffed with reference-books, look up tables, instructions, and personal notes, cf. picture one.

The aim of the MINI-project is to experiment with design of mobile e-learning (/m-learning) to support physicians especially in this first period of work. The design process has been planned as a modified version of the user driven innovation process which the authors underwent in the FEEDBACK-project [3] modified primarily because the team of physicians with whom we co-operate have very little time for participation. The process has, so far, consisted of lab-preparations and design in iteration with observations, conversations, and workshops with physicians at the ward. In this paper we present analytic results on the particularities of mobility in order to understand opportunities as well as constraints for design of mobile e-learning within this specific context. As pointed out by Hosbond and Nielsen, "It is striking that very little research has been directed at establishing requirements that do not merely reflect on the mobile technologies, but also the organizational and social context of mobility" [2]. This paper is such an attempt: to sum-up analytic findings of what 'mobility' means in this specific organizational and social context. Central design challenges and decisions are presented on this basis for a prototype currently under way.

LEARNING 'IN THE POCKET' – MAX 3 MINUTES AND A CALL FOR PERSONAL SPACE
As illustrated in picture one present learning support seems to be 'in the pocket'. Trying to understand why, limits in time and personal learning space seems to be central: As for limits in time the pocket is close to the physician and as for personal learning space the pocket seem to be the only (or most?) personal space for the physicians. Picture two shows the shared office of the 16 registrars.

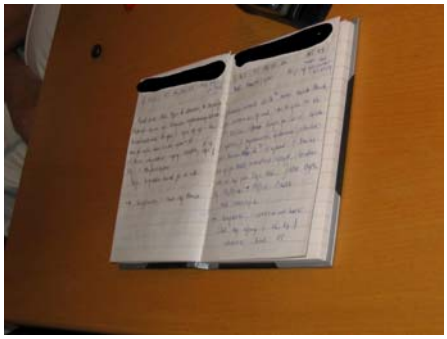
One fixed shared PC is located in this office; other PCs are located in shared offices at the ward. Spaces are typically shared, which also include learning spaces. Shared learning spaces are found and organized formally e.g. at shifts, morning conferences, and x-ray conferences, where physicians reflect with each other (picture three is such an example from a morning conference analyzing x-rays).

A consequent design aim has been to design a personal learning space/an "e-Pocket". Tablet PCs and flat panel displays at the ward were rejected by the physicians for being too big and too un-personal. Hence, the hardware choice is PDA's.

Limits in time, e.g. for preparations are described by a physician explaining that *"When you are called, you don't run, you walk, because then you have time to look up some information on the way"*. Preparations are typically made 'on the way' i.e. in hallways, elevators, toilets, or by making a minor backstage at the bedside while nurses talk to patients. Time is by the physicians limited to max. 3 minutes. *"If you have more time you sit down in an office or at a PC at the ward"*. The timeframe of 3 minutes has set the challenge for information architecture and interaction techniques and made us consider non-text interaction techniques (cf. a following section).

KEEPING TRACK – INTERRUPTIONS AND MULTITASKING

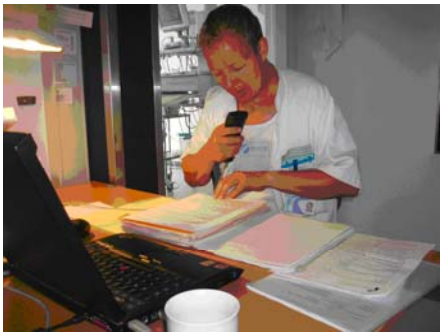
During our visits shadowing doctors on duty we saw how their rhythm of work consists of breaks away from one thing, having to pay attention to another, re-assuming the first, being disrupted again, etc. In the short intervals, where they shift their attention they try to mentally prepare for the next thing. They are multitasking and trying hard to treat one case at a time. But fact is that they are constantly interrupted. Hence keeping track seems to be an obvious way of supporting their learning (and memory). In their pockets they keep notebooks (cf. picture four). Notes are short and ephemeral because they are 'intermediaries', made quickly, on the move and used for memory and (sometimes, if time allows for it) to follow up on patient records, the diagnosis, outcome, etc.



A consequent design aim has been to provide for personal notes. Major constraints are here (again) related to interaction techniques and information architecture in order to design for track which can be made and which are afterwards easy to find. Acknowledgement of the overwhelmingly many interruptions and seeing how the physicians try to fight them, also made us realized that any idea of notifications or alerts is from the outset not good. An aim must be to design against interruptions.

THE HARDWARE AS INTERFACE – INTERACTING WITH HANDS AND VOICE

The physician uses her voice and her hands all the time. She talks to colleagues, to secretaries, to patients. She uses her hands to touch the patients to feel them, to calm them. The hands are for patients, the voice is part of all action. Watching the hands of even novice physicians when they grip the dictaphone is remarkable: they are safe, sure, in control, they hold and click the button, and Whola! They start dictating.



This trait of interaction has made us try to go for dictating as a possible way of interaction when taking notes. More generally it has made us aware that when dealing with mobile technologies the hardware must be seen as a major part of the user-interface supporting interaction with e.g. shortcuts/buttons for dictating (c.f. [4]).

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An Instrumental Paradigm for Ubiquitous Interaction

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ABSTRACT
This paper addresses the limitations of the classical conceptual models and concepts, used in the personal computer user interfaces, from the perspective of designing ubiquitous user interfaces. The paper proposes a disintegration of the monolithic application concept into detached interactional instruments, creating a base for interface distribution and dynamic adaptation of tools to the use setting.

Author Keywords
HCI, Ubiquitous Interaction, Ubiquitous Computing, Instrumental Interaction, Pervasive Computing, Mobility, Distributed Interfaces

ACM Classification Keywords
H.5 Information interfaces and presentation

Within the last decade, the use of computers has broadened explosively and is no longer confined to the office – computing is used and needed in almost any conceivable setting. The physical office metaphor, introduced in the Xerox Star user interface [4] which our contemporary graphical operating systems are descendants of, is threatened by this development, and has over the years become distorted and replaced by conventions for interaction. The ongoing development of mobile technology and new ways of interaction – whether it is called pervasive, ubiquitous, tangible or ambient computing – challenges the limitations of the well founded understanding of classical interaction with *one user – one technology – one application*. We[1] address these new kinds of interaction as *ubiquitous interaction* to gather them under one general term. Ubiquitous interaction is characterised by multiplicity; there is no one-to-one relationship between the user and the computer. There is not necessarily one single unified interface to a system. Instead, one will see one-to-many or many-to-many relationships between the users, the applications and the physical artefacts. These types of distributed interfaces place the user as the centrepiece in the user interface. The user's image and understanding of the system is created from the joint perception of the configuration of artefacts, and not from a singular interface as in interaction with a personal computer.
In this paper I will look towards design of ubiquitous interfaces and raise the question whether the conceptual models for supporting classical user interaction on a personal computer are suitable for ubiquitous user interfaces. Subsequently, I will discuss alternatives to central interactional constructs.

One of the goals we see in creating ubiquitous interaction, is supporting fluent interaction with distributed interfaces and interaction in dynamic configurations of interfaces distributed on various technological artefacts. Hence interaction should be supported not only in the office, but fluently between being stationary and being mobile, and not rely on a single encapsulating personal computer.
The predominant way of handling tools on a personal computer is by encapsulation in applications. The concept of applications was a construct Apple introduced in their first graphical operating system. The Star system, which Apple based their design on, was purely document oriented. The editing functionality in Xerox Star was integrated in the document; applications were never thought of as something explicitly standing alone. Never the less the application stands strong as a central concept of today's computer use, both as a commercial construct and as *the* way of using a personal computer. It is hard to find a direct counterpart to applications in the real world. Applications can resemble a collection of tools gathered to perform a certain task in the physical world – the architect or the painters tools – but an application lacks the dynamics of such a collection. A brush in an application can seldomly be removed and used in another context. The specific set of tools in an application is predefined by the software developer. It is not possible for the user to reconfigure the set of tools for her own personalised needs on a low level.
The file types bound to applications are likewise an artificial construct compared to the materials of the physical world. A specific application is often needed to manipulate a given file, and there is no logical connection between tool and material. This inflexibility poses a limitation on supporting mobility, distribution and customisability of interfaces. The large applications, built for general purpose personal computers, might not be suitable for smaller devices, or devices with other kinds of inputs. Device specific applications are therefore required, which might be radically differently implemented across different platforms and technologies. Neither do applications offer much choice in features – you either choose the whole package, or something completely different.
In a discussion of software customisation, Carter [2] addresses the way architects handle their tools at the drawing board. The work is performed with a wide range of tools,

[1]The Ubiquitous User Interface Design group at the University of Aarhus (http://www.daimi.au.dk/uuid)

each with a narrow range of built-in flexibility. A pencil can be angled to draw thicker lines. These tools are independent, but can be used together to produce complex drawings [2]. The pencil the architect uses, is not only usable for architect drawings; it can also be used to write her grocery-list, or by her children to draw on the wall. The tools used by the architect are not locked to the drawing board, she can pick up a drawing and a few basic tools and use them to annotate the drawing on the way home in the train. Carter argues that this unitary nature of tools is of importance for the fluid and on-going adaptation of the work-space to the task. This is a flexibility which is missing in the current monolithic application structure, but never the less it is a flexibility which would fit the ubiquitous, interactional way of thinking.

Michel Beaudoin-Lafon similarly advocate for gathering commands in instruments to resemble the way we naturally use tools (or instruments) to manipulate objects of interest in the physical world [1]. Beaudoin-Lafon describe graphical user interfaces in terms of interaction instruments mediating interaction with domain objects. An *interaction instrument* is defined as:

> *... a mediator or two-way transducer between the user and domain objects. The user acts on the instrument, which transforms the user's actions into commands affecting relevant target domain objects. Instruments have reactions enabling users to control their actions on the instrument, and provide feedback as the command is carried out on target objects.* [1]

Beaudoin-Lafon's interaction instrument concept is placed in a context of more classical personal computer use, but it would be interesting to join his concepts with Carter's thoughts of giving computer tools a unitary and flexible nature, disintegrating the application construct, and instead thinking of dynamic configurations of instruments to perform complex interaction, and facilitating easy distribution of these instruments over multiple technologies.

The charm of physical tools with limited properties is the easiness of decoding the actions afforded by the environment when the tool is grasped. A surface of basically any kind affords to be written on with a pen[2]. To achieve this in a computing environment, one would have to rethink the way we represent our data, files and documents. Creating the same kind of affordances as in the physical world would require a simulation of a small Gibsonesque ecological reality [3], where afforded actions were not hard-coded, but consequences of the relationship between the domain objects and the properties of the interaction instruments. The domain object should not be specified by a specific type, but instead by properties resembling physical properties. For instance an object specified as being a two dimensional surface, a three-dimensional geometry, or two-dimensional surfaces associated with a temporal dimension etc. Interaction instruments should be defined by what they act upon, and how and what they modify through use. For example, a simple drawing tool would be able to draw lines on a surface, a text editing tool would manipulate and write text on a surface and ruler tool could measure distance on a surface with an associated unit and scale.

Applications for a personal computer are geared towards interaction with a mouse or a keyboard, but one can no longer assume those devices to be the only input devices, and one can only guess of the character of future input devices. Input devices should be defined on a more general level, specifying what they can manipulate and how. A mouse and an analogue joystick both control a two dimensional speed vector.

The liberation of domain objects (file types) from specific static sets of instruments (applications), and the liberation of the instruments from specific input devices would let the user be able to rely on the relational affordances between physical and logical instruments and logical instruments and domain objects. This liberation would also support the mobility of the above described scenario. Ideally the architect would be able to work on a general purpose computer simulating his drawing board, interacting with a large configuration of tools, and then move a few of the tools and some domain objects to a handheld device for editing and annotation on the way home. Thus he maintains a consistent interaction customised to his needs with a subset of the tools from his workstation.

[2]Given it is culturally and socially accepted.

FUTURE WORK

This short paper presents very preliminary, abstract thoughts on an instrumental paradigm for ubiquitous interaction. A whole myriad of conceptual and practical considerations lies ahead. On the conceptual side: How is data presented to the user? Can views on objects be thought of as instruments? How is a configuration of tools handled? How can communication with other people be thought into the instrumental paradigm? What is the level of functionality required of an instrument? And of course on the practical side: What kind of data structure can hold such generic data? What kind of network infrastructure would be required to handle fluent distribution of instruments?

I believe the new developments in ubiquitous interaction force us to reconsider the fundamental concepts underlying the way we use computers. In this paper a small step in that direction has been presented.

ACKNOWLEDGMENTS

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Should patients participate in new ICT in health care?

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ABSTRACT

This paper points to the lack of involving real patients in future workshops and prototype testing for health related ICT development, while at the same time involving real health care professionals in the work.

We point out that this relates to power relations and may be an ethical question for the designers, in the same way as pointed to by Ina Wagner in [8].

INTRODUCTION

Risan [9] points out that a new ICT system might challenge the existing power relations.

In this paper we are pointing out that physicians, nurses and patients have different power relations, and that in many studies the *patient role* is not taken as serious as the *health care professional role* when dealing with participatory design and user testing.

Ethical issues

The paper [8] by Ina Wagner points out several ethical questions an ICT designer might be involved in. In particular she points out that a new ICT system may either support the current power structure between physicians and nurses, or challenge the existing power relation. And she identifies this as an *ethical* question. A similar ethical question we believe exists also for the patient-clinician relations.

Of course in the case of involving real patients in the development of ICT systems we will also face some ethical questions more along the medical line, as formalized in Norway by ethical guidelines [3]. We must e.g. make sure that the introduction of the ICT-system does not harm the patients, but also other issues are of relevance. [3] requirers applications and permits and takes time, and this may be a reason why real patients are often not used.

In some cases it might also be an ethical question related to giving the patient/ handicapped person a hope for a better future, while the reality is that the likelihood is very large that the prototype in question will only be used in research, and not be put into real operation.

SOME PATIENT CENTERED WORK

There are of course many studies of patients/elderly users and their behavior in relation to ICT (see e.g. Aaløkke [1]). It may however vary to what extent they have been involved in the design of the new systems (not only as testers).

Before we turn to the studies involving non-real patients we will briefly report from a small ethnographic study reporting from today's use of the patient signal button.

Todays patient signal button and public displays

The assignment in this student project [5] was to study the patient signal button in hospital wards. The group focused on the *patient side* of the button, but their ethnographic study also describes today's displays for the *nurses*.

They found lamps in the corridor near the door indicating status in the room, as well as public display in the ceiling showing (all) rooms where patient signal is active.

This study is reporting about the use of several public displays *not* reported in other ethnographic studies from hospitals (such as studies from Mexico or Århus). Not even in the paper [4], even though they have the words 'public displays' in the title[1].

One interpretations of this finding can be that by focusing on the physicians and their work these displays and the whole patient button system becomes 'invisible' also to the ethnographer. Other interpretations are of course also possible.

SOME FORMER WORK WITH 'REAL USERS'

This paper is triggered by several of the papers at the recent NordiCHI conference 2006 as well as of a rejected paper at the same conference, but other comferences and publications may be used as examples of the same things.

[6] is performing a user test with real midwifes and with fake 'pregnant patients'. The midwives where also asked questions about 'contact with the patient' (they were wearing head mounted displays). From my perspective 'contact' is a *bidirectional* relation. I find 2 questions to be

[1] This *may* of course be because such displays actually do *not exist* in Mexico. We have never seen it discussed (not in other papers from Mexico neither) The display may of course be either public like in most of Norway, or private via pager/PDA

of relevance here: 1) Why were not real patients used? 2) Why weren't the (real) patients asked about the contact?

Paper [2] deals with combined use of a PDA and a PC screen. The user tests were carried out with real physicians, real x-rays and fake 'patients with elbow problems'.

Now to the rejected paper [anonymous]. (This information is based on oral communication with one of the authors during the conference). The paper was about a mobile application for reporting health related issues, and the intended user was the patient. However the reported testing was carried out on students / ICT researchers acting as patients.

A general impression is: If the scenarios involve real health care workers as well as patients, then (maybe for simplicity) the patients need not be real.

FUTURE WORK

As technicians we want to build *generic* technology that can be used in a variety of settings. But we know that healthcare is a specialized sector and the applications may need more tailoring to the various specific situations.

We will propose 2 directions for further work:

Testing generality vs specificity

[2] tested the 'handover' between PDA and bigger screens via several types of metaphors. To test the same metaphors in various situations/contexts seems a natural candidate for further work. Some of the settings may involve a handover from a PDA to a bigger screen during a phone call (such as one doctor talking to a remote real doctor via phone, while examining a patient and using the patient screen). Other scenarios may involve ICT workers discussing e.g. UML-models, and here it is natural to use ICT researchers as real users.

Some other scenarios may involve the real patient to a larger extent. Patients who want to prepare their questions and pictures on their own mobile before talking to the doctor may also be an obvious candidate, and this brings us over to the next topic.

Patient user involvement

The use of a device similar to the 'peer docking station' from [7] may allow the patient to share videos and pictures with the doctor. This may be a natural variation of the setting in [2].

It is also a fact[2] that while the doctor may in most cases be an expert over the patient at the hospital, the patient him/herself may well consider him/herself to be more of an expert on their own (rare/special) disease(s) than the local physician ('fastlege' in Norwegian).

We believe that cooperation with chronically ill patients (users) and their interest organizations may be a natural step forward. We believe that chronically ill users may have a more reflected view on their needs than an arbitrarily ill patient being hospitalized for 3 days.

CONCLUSION

We have described several HCI related studies in health care sector where user tests are carried out with real health care workers but with fake patients. We believe that more active participation and empowerment from real patients may be an interesting way forward, and we propose to start with chronically ill patients/users and their interest organizations. We believe this may come up with other issues, and other proposals for new ICT systems, as well as other results from user tests.

There are some ethical issues if we involve the real patients, but there are other ethical issues if we ignore the patients and their interests. The ethical questions should not stop us from involving patients as participants in participatory design.

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[2] This claim is based on oral communication with real chronically ill patients at a pain group.

Distributed Speech Recognition as an interaction paradigm for mobile information access - ongoing work at Aalborg University

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Abstract

This paper presents a distributed speech recognition (DSR) paradigm for information access on mobile devices. The rationale and basic architecture is introduced and two prototype systems are briefly described. The first system applies the state-of-the-art DSR technique and knowledge-based Information Retrieval (IR) processing for spoken question answering for a soccer test domain are presented. Though the prototype system can only answer queries and questions within the chosen domain, the system has the flexibility for being ported to other domains. The second prototype is an application for a car rental service, where a more elaborate dialogue is conducted to achieve the users' goals. Finally, the prospects of such services are discussed and a usability test scheme is outlined.

Categories and Subject Descriptors

C.3 SPECIAL-PURPOSE AND APPLICATION-BASED SYSTEMS Microprocessor/microcomputer applications, Real-time and embedded systems, Signal processing systems

Keywords

Distributed Speech Recognition, Intelligent Search Engines, Spoken Dialogue Systems, Mobile Information Access, Human Computer Interaction

1. INTRODUCTION

Search engines like Google undoubtedly belong to the most popular information services accessed from conventional desktop computers with web access. Likewise, services such as ordering train- (cinema-, flight-, etc.) tickets, home banking and other consumer products via the WWW are or have already become the preferred mode for the typical Danish user. However, on mobile devices such as personal digital assistants (PDAs) and smart phones, the accessibility to these kinds of services is not optimal as they often require quite extensive keyboard input and large-sized computer screens for browsing and displaying the information. Consequently, recent research has focused on studying efficient techniques to provide more advanced interaction paradigms, such as speech recognition.
Speech recognition in a very limited form has been around on mobile phones for a number of years, but is essentially restricted to user-trained voice-dialing and is rarely used. Server-based solutions, such as the "Rejseplanen" by DSB or the "Voice Check-in" by SAS are becoming more common, also for the Danish language, but in these cases, the only modality available for both input and output is speech, and the phone is just used as a "dumb" voice terminal.

To alleviate these problems, we focus on speaker independent Distributed Speech Recognition (DSR) in the work presented here. DSR essentially splits the processing between the client (e.g. a Smartphone) and a backend server as shown in Figure 1. Furthermore, it is designed to be noise robust and very low-bandwidth (less than 10 kbit/s), allowing a multi modal user interface via a standard GPRS connection.

DSR has a wide range of potential applications because of its advantages both in reducing the computational requirements and power consumption for devices at the client side and in facilitating the effortless update of the core part of the recogniser at the server side [1]. The current paper presents our application of DSR in two distinct prototypes:

- Accessing information retrieval (IR) services on remote servers from mobile devices. In collaboration with the Software Intelligence and Security Research Centre (SIS-RC), Esbjerg, Denmark, a prototype system [2] has been built employing two main components: An IR-system with a specialized question answering engine and a DSR-system implemented on the basis of the ETSI-DSR advanced front-end [3] and the SPHINX IV recogniser [4]. Danish "Superliga" soccer news has been chosen for the application domain

- A system for renting cars, similarly to e.g. Avis' or Herz' WWW services. This prototype demonstrates how a more structured task can be addressed by a multi modal speech centered approach. To facilitate comparison studies, the system is developed in two versions; a GUI-only and a speech based one.

The DSR-system is of course language-dependent (in this case it employs acoustic models trained on Danish speech), and the acoustic search is currently constrained by a grammar designed explicitly for the domains. As a result of the work on the two prototypes, a generic framework and a platform for DSR based applications is currently under development

The next sections focus on the general architecture of the DSR system and a brief presentation of the IR task..

2. DSR SYSTEM

This section briefly describes the DSR system. Figure 1 shows the architecture for a PDA based system. "AFE" refers to the ETSI-DSR advanced front-end [3], which contains an elaborate noise reduction algorithm for increased robustness of the speech recogniser in noisy environments.

To increase system usability and flexibility, three typical recognition modes are represented, namely: "Isolated Word Recognition", "Grammar Based Recognition" and "Large Vocabulary Recognition". The core module at the server side is the open source SPHINX IV speech recogniser [4].

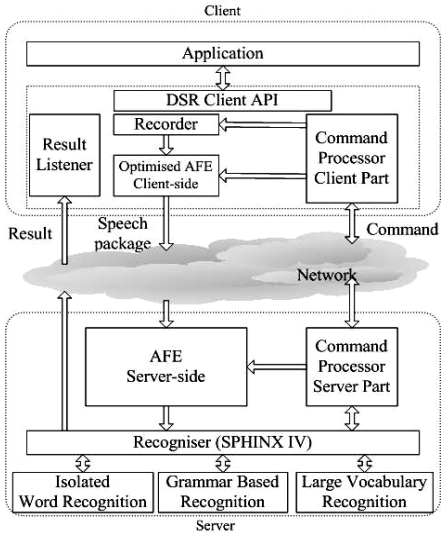

Figure 1: The DSR architecture.

A "Command Processor" is implemented at both the client and server side to support the interchange of configuration commands. Potential commands include control commands to start or stop recognition, choice of recognition mode, commands providing feedback information from the server to a client (e.g. success or failure of any user request), etc. The base system has been extensively tested using WiFi connections, emulated 2G and 3G networks, as well the standard GPRS network.

3. THE PROTOTYPE APPLICATION

The IR prototype is described in more detail in [2]. It receives the user's questions about the chosen soccer test domain in text form and determines whether the question should be sent to the search engine or can be answered directly using domain-dependent Information Extraction (IE)-like techniques. The server continuously updates the knowledge base by retrieving sports news via the WWW in the form of RSS articles from diverse news providers. These documents are stored in the database for retrieval. Figure 2 shows the application user interface. Due to space restrictions, the second prototype is not presented here.

Figure 2: Screen shot of the soccer IR service. Input (top left field) can be entered either by voice or by stylus. Search results are presented as text and shown below.

4. CONCLUSIONS AND DISCUSSION

As the prototypes systems here are currently in the final stages of development, we have not yet carried out extensive usability experiments to verify the users' preferences for speech over e.g. keypad or stylus input. However, both prototypes have been developed with this in mind and it is e.g. possible to enter text directly into the query field of the GUI shown in Figure 2 using a stylus. Likewise, the Car Rental application has been developed with two distinct interfaces. We plan to test the prototypes in a number of real and simulated environments, as mobile services in their nature can be used in very diverse environments. Some of these might be public as well as noisy (e.g. a railway station), and the users' input preferences are expected to vary considerably depending on the context. Obviously, services employing spoken interaction must anticipate this, to become widely accepted.

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Design probes for evaluating kitchen RFID prototypes

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ABSTRACT
This paper describes the use of design probes as prototype feedback tools in 20 Danish families in the ongoing project 'Helpful food of the future'. The 20 families received a working PC prototype that allowed them to access information and services related to the RFID tagged food. The probes, used for self-documentation, are designed both along explorative lines, to receive a personal impression of each family's kitchen life, routines, attitudes, exploring the kitchen context for design, and on a concrete level, to obtain direct feedback on the user interface and design concept of the prototype. The latter aim of the probes as a feedback tool on a product in use will be especially interesting to reflect upon with completion of the project, as the method so far mainly has been used for inspiration purposes and to inform about a certain design context.

Author Keywords
Innovation, design probes, user feedback, kitchen context, RFID technology

INTRODUCTION
The 'Helpful food of the future' (Fremtidens hjælpsomme mad) is a project initiated by the Innovation Lab in Århus, organized in collaboration with the Mads Clausen Institute, a range of Danish food manufacturers and local technology companies. The Mads Clausen Institute's responsibilities are the design of the concept and user involvement in the project. The project is financed by the Ministry of Science, Technology and Development a part of the initiative 'IKT from ground to table' (IKT fra jord til bord)..

The main goals of the project are to a) explore the potential of Radio Frequency Identification (RFID) technology to tag food in the home context, and to b) find out, if, which and how information/ services provided through the use of such technology can strengthen a trustful relationship between consumers and food manufacturers.

THE 'KITCHEN GUIDE' SET-UP
The premise of the project was to equip 20 households with a functioning prototype for a test phase of 2 months. With this and the focus on RFID technology the project appears to be taking a technology-driven approach to innovation. However as we regard the prototype as a product in development, merely a tool for communication with the users around the design, we consider the project in the light of user-driven innovation. This follows the new urge of companies and researchers to prioritize user-driven innovation, rather than the traditional approach starting with technology (Sanders, 2005). Here the probes applied in the project play a major role.

For the experiment, all families were equipped with an RFID scanner, connected to a laptop permanently on-line. A variation of food products was put together (in the categories dairy products, meat, bread, juice and candy), which is then delivered with RFID-tags to their homes twice a week. The tagged food baskets are delivered from in mid September to mid November 2006. By scanning a product the family members can access information and services relating to that specific product in their web interface the 'kitchen guide'.

There are four main functions in the 'kitchen guide': 'Food magnification glass' (for details on product, it's lifecycle and direct contact to manufacturer), 'Food planner' (for food and kitchen life planning), 'Recipe architect' (to, in a playful manner, search recipes according to the food at home), 'Shopping helper' (text message function for shopping list away from home) – links apply across the functions.

Picture 1: The laptop set up with the 'kitchen guide' web interface at one of the family's kitchen.

THE DESIGN PROBES IN KITCHENS

'Cultural probes' were first introduced to the design community as a tool to provoke responses from the users to inspire the design team – "an alternative to more traditional forms of user research" (Gaver, 2001). The probes concept has since been recognized also for its potential of encouraging the users to participate actively in the design process (Mattelmäki 2006).

Considering the use context of the prototypes, being private homes, merely kitchens, it was necessary to find a way of being able to be as close to the actual use situations as possible. Moreover the aim was to create a platform for feedback that is available to all members of a household. That is why design probes appeared to be appropriate to let the families self-document in the test phase. The probes, called 'diary package' are used to both gather explorative information on kitchen life and concrete feedback on the concept and user interface.

Picture 2: Metal boxes for the design probes with a personal nametag for each family at the front.

The 'diary package' design probes

Overall the 'diary package' was designed with the ambition to gather valuable information and feedback from the users, as well as inspire them along the way to actively participate in this project. The package included an introductory letter, as well as a specific introduction on each element itself. The package consists of three main elements, which are:

- A diary (A5-sized book with provoking questions spread over time)
- A disposable camera and postcards for documentation of pictures
- A function barometer (two A3 posters to mount on kitchen wall)

The diary addresses different areas of information: facts about the family members, roles and activities in kitchen, attitudes (technology, food), routines (before/ after 'kitchen guide'), trust to food producers. The disposable camera should be used for 3 purposes: documentation of shifting the physical position of the prototype, any special occasions 'odd moments', specific photo tasks assigned in the postcard set (e.g. take a picture of the most important place in the kitchen and reason why it is). The function barometer is the closest knit with the actual concept, where the users are asked to mark any good or bad comments on the functions and overall concept (in a calendar-like set-up).

Picture 3: Elements of the 'diary package', which were box, introductory letter, diary, disposable camera & postcards, function barometer, pens.

CONCLUSION

From the first workshop it became clear that the users could see potential in extra services around food products, as long as the information from the manufacturers can be trusted fully and gives not only the "romantic" perspective on the products. The probes, in connection with family interviews are expected to help evaluate the interface and concept, look at kitchens as design context, this building further upon the input so far received from the users. Furthermore with the completion of the user involvement and the final activities, the conclusion on how the design probes worked, as set up in this project, are still to be made. This however bears the opportunity to further explore the probes as a feedback tool in design projects – specifically those, where the context is less accessible for the researchers like in this case the private kitchens are.

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Design Research in Conflict With HCI

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ABSTRACT
In this position paper design research is sketchily unpacked in relation to HCI. Design research is seen as something different than general systems development research of HCI – seen from the perspective of the more traditional design practices and principles based on a creative and aesthetic stance in the design process.

The position paper is an extract of my forthcoming PhD-dissertation, that – among other things – discuss this relationship within the science of design.

DESIGN RESEARCH
Design in a research perspective can be seen as either something distinctly different than other types of inquiry and traditions, or we can look at it as that which can bring together a range of different scientific disciplines and traditions into a shared move forward in creation: the part of research where knowledge from various places is put into action in context and an actual product. The first perspective will point us to looking at what then is specific and exclusive for design as an activity. We see today that several research disciplines are involved in designing, but there are some that use the term "design" to define themselves as a disciplinary category. The second perspective could point towards what has been known as "action research", or towards another similar term "the constructing sciences". In other words, one can look at the current state of interaction design research either as in conflict with the surrounding disciplines in HCI, or as interaction design as the term denoting the confluence of disciplines in the same field. Both perspectives are correct and can be seen in the field today, and both are interesting and could yield.

In a Latourian [1] perspective the aim of this paper is not to make a tough and rigid, undeniable and unfalsifiable definition of design research, but rather it should be seen as one way of describing design research and place it into a current discussion of science and design research. My goal is to make a wide *proposition* of a foundation as opposed to a narrower but deeper definition of design research. The topic of design research has been debated widely in more than 40 years since Herbert Simon made his famous statement about a 'science of design' in his series of lectures 'Science of the Artificial' in 1969 at MIT [2]. Right now there is a renewed interest into the subject mainly since design research has engaged in interaction with the technological and sociological sciences in Human Computer Interaction (HCI) research, but also because there seems to be a general trend towards a 'scientification' of a range of disciplines, design being just one of these. This has extended the idea of design research from the traditionally more technical disciplines to the more aesthetically oriented design disciplines, where a research tradition is not as strong, and where the process of design is viewed as a less structured process, described by such terms as working with "wicked problems" [3] or working across "hermeneutical gaps" [4]

Many other participants in HCI make designs, innovate and get new ideas for technologies and applications for technologies, however they do not necessarily apply design thinking to this process. HCI is filled with constructive sciences and the following discussion of design research is not an attempt to state designers of one background as superior to another, but rather an attempt to focus on what the differences are between designers from technical backgrounds and designers from aesthetic backgrounds.

The Conflict of Design Research in HCI
The science of design is in turmoil these days. Within design research we have not reached what Thomas Kuhn in his description of the shifting of paradigms [5] called the state of puzzle-solving normal science. This is when a scientific community knows what its foundation is, it knows how to look at problems and even what the next problems to be solved are. There is a sense of coherence and achievement. As design institutions are becoming aware of the potential of doing research, both in financial, educational and a wider disciplinary perspectives, there is an emerging need to understand what design research is and how we distinguish good from bad research. Pragmatically this is due to the distribution of funding and the upholding of scientific value in the broader field of interdisciplinary discussions of subject matters. None or very few subject matters are isolated to the scrutiny of only designers doing research. There will always be a discussion between varying researchers and their concepts of quality in research. In the conflicting perspective design research is engaged by both types of designers, engineering and creative, but they disagree on who works correctly with design.

So design research is a form of science still in its formation and integration state. It has not reached the consensus of normal science and there is still a great deal of debate on what constitutes the base of the discipline, what could be called the dominating disciplinary paradigm that defines the field. Paradigms can be seen as overall concepts that define the world and how science act in it, concepts on such a high level that they are integral part and parcel of researchers worldview, and therefore almost invisible to those working within this paradigm. However shifts in paradigms also take place on smaller levels in less dramatic ways. And especially when looking outside the laboratories of the natural sciences paradigms become a multiplicity of traditions of one field or "schools" of inquiry within a field like the ethno-methodological tradition within ethnography [6]. It makes sense to claim that one branch of science can be in discussion of its paradigm while the neighboring sciences are not in this same sort of existential crisis, but simply discussing nuances of the agreed-upon ideal. So in order to describe what the current conflict or dynamic is within the science of design, this seems to be a valuable concept. The conflict that design research is facing as a part of HCI-research seems at first to be a conflict of solidity of paradigms.

This is part of the current frustration of design research. Creative design [7] is at its foundation a fundamentally different way of thinking than that of the dominating notion of scientific inquiry, thus the results of design research are often unable to fulfill, or uninterested in fulfilling the characteristics of good science as it is defined by these dominating perspectives in HCI. Since design research is in its own formation process there are no solid criteria for discerning good from bad or lacking science. But in HCI there are plenty older and more respectable types of scientists [8] participating from fields where the standards are more solidly defined. These types of research have a better foundation for defining the criteria on which the good and valid results are judged and thus also defining how research is to be undertaken if one wishes to be successful – and in this field-of-science perspective that means to be accepted into the best conferences, appreciated and quoted by ones peers.

Thus peers from psychology, computer science, the humanities and aesthetics, different genres of sociology and engineering can, since they have a much stronger position being grounded in (closer-to-)normal-science paradigms, define how design research is accepted into the HCI field, how the research is taking place and is approached, validated and communicated by designers. So what we see are cross-disciplinary conferences extending the same value-sets across all participating disciplines. And often this is not even seen as a problematic situation since the notion of design is that it is not of type of scientific inquiry in it self, but more of a certain way of presenting the same knowledge:

"We have been slow to recognize the peculiar indeterminacy of subject matters in design and its impact on the nature of design thinking. As a consequence, each of the sciences that have come into contact with design has tended to regard design as an "applied" version of its own knowledge, methods, and principles".[3]

Consequently the role or challenge for design research is to make this distinction ourselves and state what constitutes a good scientific study in design research. Thus, in the current struggle of defining design research, there are natural opposing forces of such statements, namely those that have been working with design activities in their own practices or fields of scientific studies. These are within HCI e.g. the field of psychology where focus is mainly on usability, and social science disciplines where focus is on appropriation and use of technology in the everyday context of the users. Similarly engineering and computer science have a strong interest in design from the methodological level in e.g. participatory design, which was developed with computer system development in mind, and on the product, prototype or what one might call the manifestional level, where many of the important and influential innovations of the last decades have come from these technological and natural science based disciplines. Defining these activities as design spreads the notion of design into many disciplines, potentially either devaluating design as an activity or linking multidisciplinary efforts towards creating the new.

But is there such a thing as a science of design based on design's own terms; aesthetic inquiry and sensibility as opposed to pure logic?

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User Navigation in 3D Geovisualization

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ABSTRACT
When visualizing geographic 3D models, different navigational regimes are developed by different software producers, ranging from flight simulations to various mouse/key actions. Navigation is, however, the first and most demanding task of the end user, and navigation often becomes an obstruction for the end user exploring the models and their content. In literature, navigational investigation usually consist of space cognition, but here navigation performed in three different software products is compared, focusing on mouse and key interaction. For the subjects participating in this test, simplicity and control seems to be buzzwords, despite the fact that simpler solutions might deliver slower solutions.

Author Keywords
3D software, navigation, interaction, software comparison methods.

ACM Classification Keywords
Interaction styles.

INTRODUCTION
3D Geovisualization is an upcoming discipline, where geographical objects (topography, vegetation, buildings, roads) are being visualized in three dimensions [1]. On top of the geography, any type of additional information can be connected to every geographic position or object. The application is multiple; accurate information on pipeline position including depths, visualization of district plan and tools for the planning process, are some of the obvious. Academic focus is still mainly on technology, attempting to produce still faster and more flexible systems. However, bringing quality to the end users in terms of easily available, understandable and meaningful information is still a limited issue in today's literature.

Navigation in 3D models
This paper describes a small part of a PhD-project based on the qualitative questions mentioned above, a part where navigation in 3D models is issued. Navigation is basically a question of selecting geographical objects and "on-top" information from the database of the system and send it for the user interface. 3D systems are particularly information-heavy, so this process needs to be especially fast and efficient. In addition, it is necessary to support the user's navigational intention while performing these selections, mainly because 3D navigation has a complex nature consisting of movements in six directions. But though user's navigation in 3D worlds probably has been the most investigated HCI issue in 3D, mainly in terms of space cognition [2,3], it is still the issue that gives the most users problems in achieving information and feeling at ease with 3D systems.

METHODOLOGY
To investigate how end users can increase their success in accessing 3D information, a comparison of three different kind of navigational regimes in existing 3D software is chosen (figure 1).

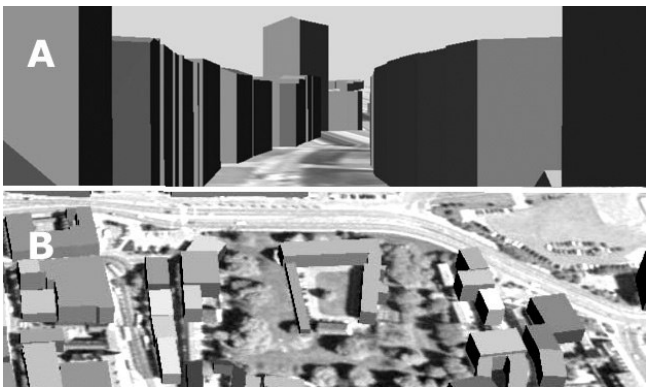

Figure 1: A: The starting point of the test seen from walking position. B: The end point, the lawn of the three-winged building in the centre, as it looks in the fly-test. The models are originally in colours.

The chosen software is the commercial products ArcScene and VR4Max Navigator Pro, along with the research product Grifinor developed at the Center for 3D Geoinformation at Aalborg University. VR4Max represents

a navigational regime based upon direct response on mouse action (one mouse click results in one movement), while ArcScene represents a classic flight simulation regime (movements are initialised). Grifinor is a mix of those two, creating a complex, sophisticated navigational regime. The comparison method consists of measuring the time spend by subjects navigating a given distance. The distance is at first traveled by walking the surface, then flying, and finally repeated for each software. Both tests (walking and flying) requires here the control of 6 directions; up-down, forwards-backwards and right-left. Before measuring, the subjects are introduced to each navigational regimes and given a short try-out period. The time measurement is expected to reflect a measurement on user's satisfaction, so that the faster the task is solved, the more satisfied the user is. This assumption is inspired by basic internet principles [4]. The subjects are afterwards asked to write down advantages and disadvantages of the navigational regimes of each piece of software.

Focus Groups and Subjects

Geographical 3D models are often available on the internet, so the focus group is initially users having a minimum of experience with computers, software and internet use, in order to be capable of finding and installing the systems themselves. Besides from this, users of 3D Geovisualization range from professional planners in public positions to private users searching the internet for information. The result is a rather varying focus group, but it is outside the scope of this simple test to distinguish between these groups, though it is relevant for the full understanding of the issue. Hence, 24 subjects are found between students and employees at Aalborg University. The main part of the subjects are experienced users of 3D systems (mainly through gaming), but none knows the three pieces of software from beforehand. Only two have no experience with 3D at all, so results are expected to be representative for experienced users.

RESULTS

Time measurements show that the flight simulation regime of ArcScene serve the fastest solution of both walking and flying tasks. ArcScene is followed by VR4Max and finally by Grifinor (table 1). In table 1, the walking test results in a much larger difference between the three software and a larger standard deviation, compared to the flying test.

	Walk	Fly
VR4Max	48,2 (29,31)	26,1 (7,79)
ArcScene	30,1 (20,11)	25,2 (14,15)
Grifinor	50,4 (33,76)	28,1 (11,48)

Table 1: Mean time in seconds used by subjects to solve the navigation tasks. Standard deviation is included in brackets.

Commenting on the three pieces of software, most subjects stress that simplicity in the navigational regimes is the most important, leaving Grifinor to represents a too advanced regime. 75% of the subjects finds the direct response of the VR4Max regime the most simple and preferable. The rest, 25%, highlights ArcScene, whose gliding flight is preferred by the few, and criticized for easy loss of overview by the others.

DISCUSSION

ArcScene is, on average, much faster to use in the walking test and a little faster in the flying test. Anyway 18 of the 24 subjects (including the two inexperienced) prefers the slower but simpler VR4Max solution. So the initial assumption saying that user's satisfaction is proportional with how fast the task can be solved, is not verified. User's satisfaction is rather reversely proportional with the mental work needed to perform a navigational task. This mental work seems to be rather demanding even for users who are familiar with 3D systems. Their preferences are namely dominated by simplicity and the feeling of control, not unlike the preferences of the two inexperienced subjects. The principle of simplicity is also applicable concerning Grifinor. The average time spend to solve the tasks in Grifinor is only a few seconds more than in VR4Max, but still no one prefers Grifinor due to its complexity. In future tests on user navigation in 3D Geovisualization, efforts should be done to define and work with smaller segments of the focus group. This makes a comprehensive discussion of work flows topical for these segments, where for instance zooming and changing visual angles are relevant tasks for planners.

CONCLUSION

User's satisfaction is not proportional with the time spend, but rather reversely proportional with the mental work needed to perform a navigational task. To increase the user's success in accessing the intended content of the systems, it is therefore necessary to serve simple, easy controllable navigational regimes, even though the users are experienced. When comparing the three pieces of software, ArcScene, VR4Max and Grifinor, the most simple and controllable navigational regime is delivered by VR4Max, through their direct response system.

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Designing HCI Techniques Targeting Cultural Diversity

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ABSTRACT
This study is part of a larger HCI project focusing on cultural differences in users cognitive processes and cognitive tools with the aim of designing HCI techniques targeting cultural diversity.

Interaction with computers is based in the visual interface and in this paper we describe the design of a cross cultural test of visual interaction. Our point of departure for development of a test is Ericsson and Simon´s distinction between concurrent - and retrospective verbalization. We introduce the theoretical reflections which frame the design and describe our empirical design and technique for capturing data. The research work is in progress. Test are being conducted with Danish subjects, Indian subjects and Chinese subjects.

Author Keywords
Usability test, visual interface, cognitive processes, cognitive tools, cultural diversity, Think Aloud

ACM Classification Keywords
H5.m. Usability and evaluation (HCI):

INTRODUCTION
A large body of studies have shown that there are cultural differences in the cognitive processes and the cognitive tools people use (1). These studies differentiate between Westerners (USA) and East Asians – typically Chinese, but also Japanese. The research has shown that that there are differences in the way people make "causal attributions and predictions, in reliance on logic vs. dialectical principles, and in categorization based on rules vs. family resemblance and categorizations based on shared taxonomic labels vs. relationships."(2). E.g. surveys of business people show different concerns with harmonious relationships (Chinese) vs. individual performance (Americans). Chinese are more likely to propose "middle way" solutions to inter- and intrapersonal conflicts where Americans will identify one or the other side as being correct. When asked to categories different visual objects (a drawing with a cow, a chicken and a piece of grass) Chinese children would put "cow and grass together because the cow eats the grass" whereas American children would put chicken together with cow because "they are both animals". East Asians are inclined to focus their attention broadly on the field whereas Americans focus on objects and show field independence.

Usability and Cultural Diversity
The core in HCI is design of applications that the users find usable. In a western context, design for cultural diversity seems tied to the understanding of universal usability (3). However, this understanding makes it difficult to capture cultural embeddings because HCI methods are not designed to handle social contexts with cultural diversity. The cultural context of cognition and the differences in cognitive processes and tools are relevant in the global IT development, and significant to HCI because cultural context is also embedded in the methodological framework we work within and in the techniques we apply. The traditional methods and techniques have developed along with the IT industry and are based in western thinking. Yet the role of culture in the methods and techniques are seldom questioned (4), but HCI methods and techniques do not escape a cultural bias.

TESTING AND EVALUATION
Studies show that in research as well as in practice, the most frequently used usability test is Ericsson and Simons Think Aloud (TA)(5). In praxis the TA test comes in many shapes and it is often followed up with an interview (questionnaire or qualitative). Hence concurrent testing is combined with some kind of prompted retrospective verbalization relying on user´s memory (6).

Ericsson and Simon wanted to reinstate verbal data as a valid source for understanding human cognitive processes.

They make a distinction between concurrent and retrospective verbalization. Concurrent verbalization is thoughts held in short term memory characterized by Talk Aloud (vocalizations of thoughts that are already encoded in the verbal form) and Think Aloud (verbalization of sequences of thoughts held in memory in some other form, e.g. visually). The third kind of verbal data is retrospective verbalizations. These are thoughts held in long term memory, and Ericsson and Simon argue that they are error prone because they rely on human memory which influences the verbalization. When we recall we do it from at subjective point of view, and events will be structured by what we perceive as important and by our sense making where we draw on what we already know, experiences etc. Hence we will not report what actually took place, but a subjective version of it.

DESIGN OF TEST

Our focus of investigation is cultural differences in cognitive processes and cognitive tools applied. Three web sites have been selected, one from each of the countries Denmark, India and China. The sites all address the same subject and the same target groups.

Participants, Setting and Task

The participants are graduate students from universities in Denmark, India and China. They come from interdisciplinary studies in computer science combined with social sciences/humanities or natural sciences.

The data collection takes place in connection with HCI courses which are part of the students curriculum. The students are asked to carry out two tasks. A free exploration to get a look and feel experience. The research focus is participant´s experience with the web interfaces. This is followed by a specific task which is described in a scenario and here our focus is the navigation, the decisions the subjects make and why they make the choices.

Data capturing tools

The users interaction with websites is recorded with a software which allows us to capture the screen, cursor movements, clicks (right/left) and with web cam a recording of subjects face and body. The data capturing tool allows us to register mouse movements/non-movements, clicks, and study area of attention, preferences related to colours, form and composition, reading direction, navigation and pleasure. The tool also makes it possible to replay the captured recording and add speak. We replay the recording for the subjected and conducts a qualitative interview which is recorded as voice over on the initial recording.

DISCUSSION AND ASSUMPTIONS

Talk Aloud builds on the assumption that thoughts are verbal: words or strings of words in our memory. Even thoughts held in visual form (Think Aloud) are directly transformable to verbal form. But visual thinking (7) is much richer than can be voiced, it is tacit(8). Besides, we think much faster than can be verbalized and having to think aloud during a test interferes with the visual cognitive processes, just as it may interfere with the cognitive tools that are domineering in given culture(9). TA does not come naturally, and in some cultures the request to Talk/Think Aloud is so alien to the subjects that they say absolutely nothing – or when encouraged to TA – they whisper almost inaudible. Besides, in a test situation there is an unequal relationship between subject and researcher and the power and status ascribed to the researcher is a disturbing factor[1].

Our assumptions are that the technical tools we use allow us to capture concurrent data(screen, cursor movement, navigation, video) and retrospective data(interview with voice over recording), which are complementary. The tools allow the subjects to concentrate on exploring and not be disturbed by the request for verbalization, hence getting around the problem with TA which requires users to verbalize what only exist in visual form. The verbalization comes in the second step, with the interview during the replay. The assumptions is that the tools take us beyond the problem with subjective error prone memory because the user´s recall is prompted by and structured through the recording showing the actual sequence of events. This design, we assume, will get us closer to the cultural diversity in cognitive processes/tools because the visual cues the subject use influence subjects decision on what to look for next, where to move, what s/he finds pleasurable etc. The work is in progress and only analysis will tell.

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[1] In China and India social hierarchy, cultural conventions and power relations require that e.g. managers are treated with great respect as are the older generations. In some relationships a lower status persons will avoid eye-contact with a higher status person.

Users expect interfaces to behave like the physical world

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ABSTRACT
Navigation in folder structures is an essential part of most window based user interfaces. Basic human navigation strategies rely on stable properties of the physical world, which are not by default present in windows style user interfaces. According to the theoretical framework Ecological Cognitive Ergonomics, user interfaces that mimics the dynamics of the physical world, should be more intuitive and easy to use. To test this hypothesises 69 subjects solved a number of tasks involving navigation in folders in two different windows environments that varied in their degree physical world resemblance. Results showed that users had very strong physical world biases in their use of the windows interfaces. The more ecological version was thus significantly faster to use, and was preferred by the majority of users. These results seem to confirm the hypothesis and are discussed in light of the larger theoretical framework.

Author Keywords
Intuitive user interface, ecological cognitive ergonomics, navigation & orientation, embodiment, psychology, hedonism, aesthetics

ACM Classification Keywords
H.1.2. User/Machine systems, H.5.2 User Interfaces

INTRODUCTION
In 2000 Bærentsen tentatively suggested that users conceptualise user interfaces in physical world categories such as space and objects [1]. Such categories constitute the most basic understanding humans have and manifest themselves as early as 2-3 months of age. By elaborating this approach with recent findings in infant cognitive developmental research it was formally developed into a framework called ecological cognitive ergonomics – ECE for short [2]. According to ECE design of user interfaces should take into account a number of basic constraints of human cognition. These constraints correspond with stable and enduring properties of the physical world that humans have evolutionary adapted to. This basic cognitive foundation cuts across culture, gender, education, previous computer experience, and thus provides a very interesting set of guidelines for making truly intuitive user interfaces [2, 3].

The interplay between this basic foundation and higher cognitive abilities is not fully understood but some general mechanisms can be outlined. Despite powerful learning and flexible adaptation mechanisms it requires a conscious effort to bypass the reflexive behaviour dictated by the basic knowledge. Cognitive load and focus towards other tasks will thus have users fall back upon reflexive behaviour [4]. In relation to the activity theory it might be said that operational aspects of activity is typically strongly influenced by the basic cognitive dynamics [2].

HUMAN NAVIGATION MECHANISMS
Human beings along with other animals rely on a number of navigation systems for moving around in the world. These strategies include spatial templates, geometric orientation, landmark based place learning and dead reckoning. These strategies all rely that space is constrained so spatial relations remain invariant when moving around.

In contrast to other animals humans have developed a host of other means for finding our way in the world such as cultural artefacts like street signs, maps and even artificial environments completely abstracted from the physical world like graphical user interfaces. The questions arises how humans navigate in artificial environments, which are not constrained by macro physical properties and thus behaves differently. According to the ECE framework user interfaces, which comply with the basic cognitive structure, should be more intuitive and easy to use. Fewer breakdowns stemming from discrepancies between what users intuitively expect and what the interface does they should also make them more pleasurable to use. The present experiment was carried out to test this hypothesis.

THE WINDOWS USER INTERFACE METAPHOR
In command based text interfaces hierarchical folder structures constitutes a semantic relation where folders are abstract disembodied categories. In window based graphical interfaces folders and their content in addition have a spatial relationship, i.e. they can be located above, under or maybe to the sides of each other within a folder. In a sense they are embodied. Often the amount of folders outnumber the amount displayed at any moment in a window and a scroll bar is used no navigate up, down and sideways in the folder list. This spatial context *within* a folder is tracked and utilised differently in various operating systems. Windows 98 (Win98) does not track such information at all and will

always return a user to the top starting point in a folder list when navigating in a folder hierarchy. Windows XP (WinXP) however returns the user to an approximated position when navigating in a folder hierarchy. From a navigational point of view WinXP resembles the physical world to a higher degree than Win98

APPARATUS

Test configurations ran on a dual boot PC with Win98 and WinXP installed. Subjects sat at a desk with a 15-inch CRT screen set to a resolution of 1024*768 pixels. Subjects used a standard 3-button mouse without a scroll button and had no access to a keyboard. The top folder menus in Win98 and WinXP were customised to look as similar as possible.

PROCEDURE

Sixty-nine subjects had to solve two structurally similar sets of tasks in a Win98 and WinXP environment manipulated to look a similar as possible. The tasks where designed to generate equal amounts of scrolling in both versions. Subjects were asked to look in a number of duplicate folders to establish whether the content was the same. The target folders were part of a large folder list approximately three times as long as the open window, and hence required navigating within the folder list by scrolling up and down. Depending on the version, Win98 or WinXP, users had to scroll up and down the list to compare the content for the target folders. A version neutral warm-up session that required no scrolling was given in the start to familiarize the subjects with the nature of the tasks. An exit interview completed the test.

RESULTS

The WinXP version was on average 11% faster to use ($p <$ 0,018, paired sample t-test), and was preferred by 90% of the users, even by those performing faster with the Win98 version. The variance in Win98 scores was 33% greater than the WinXP scores. No users mentioned the small visual layout discrepancies between the two Windows versions in the exit interview.

DISCUSISSION

The results seem to confirm the hypothesis that interfaces, which mimics the constraints of the physical world, are more intuitive and robust to use. This is of course desirable from a functional point of view with regard to effectiveness. However, the results further seem to confirm that users in relation to more hedonistic criteria irrespective of effectiveness prefer user interfaces that match their instinctive behaviour. Generally human performances on intellectual tasks are more varied than on tasks based on instinctive behaviours [4]. The larger variance in Win98 scores thus indicates a more intellectually rule-based driven interaction style than in the WinXP condition.

GENERAL DISUCUSSION

In the design of user interfaces traditional design tools that focus upon aspects like task analysis and individual cultural factors cannot alone guide the design of user interfaces. We need also consider and take into account more absolute criteria as outlined in the ECE framework. The ECE framework seeks to embody user interfaces with some of the most basic constraints of the physical world, which guides and shapes our everyday cognitive activity.

Absolute effectiveness is not a goal in itself with regard to user satisfaction. Despite endless possibilities for making short cuts in user interfaces that are not possible in the physical world, users might actually sometimes prefer to go the entire way and have the system live up to their intuition. Despite our ability to compensate for un-ecological dynamics in user interfaces and thus override our reflexive behaviour with a focused conscious effort this is typically accompanied with feelings of annoyance and irritation. Subjects typically expressed such signs of dissatisfaction with exclamations like “no”, “how irritating”, “arrgh”, but also more subtle signs like deep sighs and snorts.

Recent years have seen a tendency to focus on more hedonistic aspects of interfaces. Researches like Jordan [4] and Norman [5] suggests that hedonistic qualities can compensate for problems of functionality. This study, however, claims that functional and hedonistic qualities are deeply interwoven. This does not rule out the approach sought by Jordan and Norman, but it does require us to look at such aspects in broader terms.

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Ringing through the mist. The art of feeding back usability results to developers

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ABSTRACT
This paper describes how three developers assessed 40 usability findings presented using five feedback formats, and explains how feedback seems to serve multiple purposes that vary over time. First feedback needs to convince and convey an understanding of the problem. Second, feedback must be easy to use before finally primarily serving as a reminder of the problem. The developers' assessments suggest that most formats may serve as a reminder but that only some address feedback's initial purpose.

Author Keywords
Usability evaluation, think aloud testing, user-centered design

ACM Classification Keywords
H.5.2 Information Interfaces and Presentation (e.g., HCI): User Interfaces—Evaluation/Methodology.

INTRODUCTION
In the usability literature the effect of usability evaluation methods has been investigated thoroughly (e.g. [4,5,12]), but how the evaluation results are fed back to a design team has however not been the focus of much work [2,3]. In the English dictionary (askoxford.com) feedback is described as: 'Information given in response to a product, performance etc., used as a basis for improvement'. Consequently the receiver needs to understand the feedback and the feedback needs to facilitate a solution to a given problem. On one hand, however, developers may not be easily convinced about usability problems [6,13], on the other, they may not be hostile to changes at all, but simply have difficulty understanding the feedback [2].

This study aims at understanding how feedback is used in order to improve the way evaluators feed back results from usability evaluations to developers and thus ultimately strengthen the effect of the feedback.

RELATED WORK
Work on usability feedback seems to concentrate on either feedback practices or feedback research. Feedback from usability evaluations often include components such as problems' severity [1,3], a clear description of the context of the problem [6,9], redesign proposals [2,9], and underlying causes of problems [1]. Practitioners and researchers also recommend developers seeing users interact with the system [8,10,11]. Law has recently described how developers need to be convinced about for example the evaluator's expertise before taking the feedback to heart [7].

METHOD
To identify effective ways of providing feedback, the question of how different feedback formats were assessed was studied in a middle-sized Danish company. Formats were chosen based on a review of related work and an informal survey about preferred feedback methods on an online professional forum. The formats were; a list of problems, annotated screendumps, a multimedia presentation, redesign proposals and a type of scenario.

The study was performed as follows. First the system was tested, 75 problems were identified and merged into 40 groups. Then the problem descripitons were formatted according to five feedback formats. Three developers assessed the 200 feedback items on five questions (Q1: *How useful is the feedback item to your work on Jobindex.dk?* (not useful/very useful), Q2: *How well does the feedback item help you understand the problem?* (poorly/very well), Q3: *How well does the feedback item help you solve the problem?* (poorly/very well), Q4: *How convinced are you that this is a problem?* (poorly/very well), Q5: *How easy is the feedback item to use in your work on Jobindex.dk?* (difficult/very easy)). The developers then worked with the feedback for three months, re-assessed it and were finally interviewed about their assessments and experiences.

RESULTS
Data show that the top rated feedback items despite the feedback format had characteristics in common. First, the problems were recognizable to the developer, meaning that the developer knew about them already. As an example developer 3 (Dev3) explains: 'This is a much more recognizable problem […] it is a problem I have been in contact with before'. Second, the problems that received high ratings were considered easy to fix: 'It's a change that can be easily overcome…that's why it has a higher rating' (Dev3). Six out of ten high rated feedback items were explained with the fact that developers agreed with the problem. Five of ten high rated feedback formats were explained with problems being easy to fix.

The lowest rated feedback items also showed similarities across formats. They would often describe problems that were hard to recognize either because the developer was not convinced about the problem, or because he needed more contextual information to understand it. Five of ten low rated feedback items were explained with the fact that the developer disagreed with the problem or found it impossible to solve. Developers explained four of ten low rated items with not being able to understand the problem.

Generally developers valued the access to contextual information and several formats are criticized for not describing enough context. 'I need to know more', Dev1 points out when discussing several low rated feedback items. Conversely, formats heavy on context are not without problems. Feedback formats, which elaborate on context of use are criticized for being tedious to use. This suggests that developers consider the format's ease of use an important parameter when assessing how a format performs.

When the developers assessed the feedback items prior to working with them, redesign proposals, multimedia presentations and annotated screendumps were rated highest of the five formats. But after having worked with the feedback items all formats were rated equal suggesting that feedback's role is not the same prior to and after use.

DISCUSSION

The study suggests that feedback serve several functions, which change over time. Understanding the problem and being convinced of its relevance is of initial importance to the quality of feedback. Context elaborates the problem making it easier to understand, and provides information on what caused the problem thus making it more convincing. When the developer is convinced of the problem's relevance and understands it, the feedback's ease of use gains importance. Ease of use and thorough contextual information seem quickly to conflict however. Having worked with the problem for a while the feedback finally needs to serve as a reminder to the developer.

CONCLUSION

The present study aims to investigate how five feedback formats serve to convince and provide an understanding of usability problems. The study suggests that feedback serves multiple purposes, which change over time. Initially feedback needs to convince developers and help them understand the problem. The degree to which a feedback format provides contextual information is crucial to how well it succeeds in convincing and explaining the problem. Having accomplished that, feedback must be easy to use in the developers' daily work. Hereafter it mainly serves as a reminder of the usability problem.

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Cultural Usability: The Effects of Culture on Usability Test

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ABSTRACT
Considering cultural aspect of usability becomes one of the key factors for the success or failure of a global product. Culture not only affects products, but also impacts on usability evaluation methods. Usability evaluation methods which come from one culture may not be suitable for another culture. This project aims to examine the effects of culture on thinking aloud usability testing, and to explore what kind of the relations and communications between evaluators and test users are most effective. The project will be primarily based on Nisbett's culture theory.

Keywords
Culture, Thinking Aloud Usability Test, Localization

INTRODUCTION

With the advent of globalization and IT revolution, we can no longer overlook the aspect of culture in the design of user interfaces and products. Considering culture aspect become one of the key factors for the success or failure of a global product. By accommodating more countries, multinational companies can earn more revenue from the international markets, especially, from Asia (such as, China and India, the two most populated countries in the world) [8].

In order to capture global markets, the products and software must be tested in all the target cultures to make sure that it is acceptable and suitable for people's characteristics in that culture. But some previous studies found that culture not only affects products, but also impacts on usability test [7].

In our study, we want to see the impact of culture on usability tests. The usability test evaluation method, which is also called thinking aloud method, has been extensively applied in industry to evaluate a system's prototypes of different levels of fidelity [3]. The primary goal of a usability test is, from evaluators' observations and analyzing users' verbal and non-verbal behaviour to find a list of usability problems.

During a usability test, representative users are required to complete pre-established tasks by using the system. This measurement is largely related to specific users and specific tasks. However, the problem here is that people differ across regional, linguistic and country boundaries and therefore, if the evaluator and user from different culture, they may be strongly influenced by their local cultural perspective, perception and cognition, so the interaction and communication between them may be different from those who from the same culture.

When doing the test, participants in different culture may explain more clearly to the foreigner. But the users' "additional" explanation may affect their thinking process, since some researches found that inducing the subjects to explain their solution very likely changes the structure of their thought process [1], which in turn may affect the results of the usability test.

The requirement of evaluator's cultural background is also related to the application or product which is tested in the target culture. There are two approaches of designing products for international markets, globalization and localization [2]. "Globalization seeks to make products general enough to work everywhere and localization seeks to create custom versions for each locale" [2]. In this study, we will use a localized application, which adapt specific cultural elements for a specific target culture. For a culturally localized application or product, the results of the usability test may be more related to the evaluator and user's cultural background.

Research Question

In the established thinking aloud usability evaluation method (TA UEM), what kind of relations and communications between evaluators and test users are most effective in terms of finding relevant usability problems in culturally localized applications?

BACKGROUND

Culture

The definition of culture is various. Since my research purpose is to see how the established usability test which derived from the Western countries works in other countries, in my study, temporarily, I just define cultures as to be associated with national boundaries. This project involves three countries: Denmark, India and China.

Cultural Theory and Usability Test

This project will be primarily based on Nisbett's culture theory [4, 5]. His theory focuses on the cognition and perception difference, which is more relevant to usability test. Because thinking aloud usability evaluation methodology is to ask users to work on typical tasks and to verbalize their task performance and thought process [6].

The whole process involves users' cognition and perception characteristics. The results of the usability test, i.e. usability problems, which are found by the evaluators, are also involved in the evaluators' cognition and perception of the whole test process. When cultural differences exist between the evaluator and test user, some usability problems might be masked instead of being discovered. If ignored the culture influence, the usability test UEM methodology may be inefficient to provide accurate information about the localized product.

In Nisbett's theory, there are many cognition and perception differences in the east and west. In our study, so far, I want to consider these aspects: Causal Attribution, Situation-centered vs. individual-centered, Task-focus and Socio-emotional Relational Orientations

METHODOLOGY

Mixed Research

In this study, I will try to bring together approaches that are included in both the quantitative and qualitative formats, which are called mixed research methods. I will primarily focus on quantitative data, and combine some qualitative data to enrich the research. Using quantitative data could do the statistic analysis, which can make the results more credible and inferable. But the qualitative research is also very necessary in this study, since we need to analyze the users' thinking aloud protocols, communication and interaction between the evaluator and test user.

We will use camera to video the whole usability test course. And then analyze the verbal protocols, communication and gestures by watching the video. A coding system will be worked out to transfer the video to quantitative data, in order to do the statistic analysis. Since the focus of our study was the process of usability test, especially the interaction between user and evaluator, in the coding system, evaluator's conversation, evaluator's behaviour, test user's conversation, test user's behaviour were all coded.

The quantitative data can also include communication effort scale and satisfaction scale, which could be rated by the user after the usability test.

Variables

In our study, the main variables are the culture factors:

1) The evaluator and user from the same culture or from different culture;2) The knowledge that the evaluator mastered about the target culture.

Besides the culture variable, there are other variables that could be added to see their effects on TA UEMs. The variables could include: User's experience of going abroad, education level, novice and experienced evaluators.

The dependent variables in this study include the number of usability problems that are found by the evaluator; suggestions, positive comments, negative comments and culturally related comments which are made by the users.

CONCLUSION

From this research, we will analyze the question of culture influence on thinking aloud usability evaluation method from a theoretical and empirical viewpoint. I aim to investigate what kind of relations and communications between evaluators and test users are most effective for finding usability problems of a culturally localized application during the usability test. In our study, we use a cultural localized application in the usability test, in order to see a foreign evaluator, who does not have much knowledge about the target culture, whether he/she could find the accurate and important usability problems. It is a very important issue that needs to be considered in the industrial area. Since being an evaluator, he/she needs to do many kinds of usability tests involving a variety of fields, how much knowledge he/she has to master in order to find the critical usability problem of the product/ software? What kinds of relations or communications the evaluator should build during the usability test in order to get more important information about the product/ application?

To figure out all these research questions, we will use mixed research methods, with controlled experiments to collect data and analyze them in Denmark, India and China. Our final purpose is to design a new and more effective thinking aloud usability test without culture bias for the global market.

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Experience modeling of configuration practices

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ABSTRACT
One of the challenges in designing supportive technology for industrial work setting is to gain understanding about the relationship between user's practice, technology and social issues and to use this knowledge in designing. To overcome such challenge, previous studies have argued that experience modeling can be used as a bridge between understanding and designing. In this paper, we look at the main elements of a graphical experience model used in designing for configuration practice in industrial refrigeration setting. We learned from our process of constructing an experience model that it works well as an analytical framework for understanding the various layers of relations influencing users practice. Experience modeling also works well as a generative design tool since it embraces both the complexity of user's and design practice.

INTRODUCTION
When dealing with a less familiar and complex research field, gaining and sharing understanding among multidisciplinary design team can be a challenge. In this paper, we aim to contribute to the field of industrial configuration and HCI in general. We particularly interested in the participatory and user-centered design aspects of our research project, which deals with complex industrial workplace and large multi-disciplinary research team (research consortium involving various academic and industrial institutions).

Industrial Configuration
The User Supportive Embedded Configuration (USEC) research consortium has initiated a long-term project to investigate the possibilities of developing new technological ways to configure large and complex systems. One corner of this project (on which the research in this paper is established) is interested in researching the user's aspect of configuration. In our project, the users are service technicians who install and maintain industrial refrigeration systems.

Based on ethnographic studies conducted in Denmark, Australia, and Indonesia, we learned that though highly skilled in maintaining technical systems, most technicians whom we have met still have difficulties in relating to the current digital configuration technology. Before plunging our heads deep into the technicalities of configuration, we believe that a better understanding of where and how the users stand among such system and community of practice is key for maneuvering within such unfamiliar and complex field and designing better supportive technologies for users.

Experience models
In current discussions in HCI concerning the role of ethnography in design, there are studies [3, 4] that have given several examples of tools that can be used to bridge research and design. One that interests our research is the use of experience models as tool to visually represent relationships and experiential processes [4] that users go through in their practices. Jones [4] points out that as a reference tool, experience models help the design team to visualize various narratives about work practice, representing both individual as well as group practices. But, which narratives would one need to visualize?

Blomberg et al [2] points out that it is important to visualize the ways people create meaning, interact and organize their experiences. In this way, the experience model can be used for designers to challenge the general assumptions about user's practice. In the following section, we explain a graphical experience model that is used to visualize relationships between technician's configuration practice and the socio-technical dimensions of their work practice.

EXPERIENCE MODEL OF CONFIGURATION PRACTICES
Our previous efforts in analyzing fieldwork material have led us to a current synthesis about the relationships that exist in the practice of configuration. In observing the ways technicians improvise and work around various problems, we notice that configuration is not a single isolated action, carried out as a task only.

Collaborative sense-making of complex systems
Configuration involves a range of activities (watching, reading, feeling, prescribing, etc.) engaging both skilled and novice technicians. This process of configuring a system is structured, yet highly improvised to cope with systems complexities. The circular form (Figure 1) of such event represents the collaborative and skilled quality of these activities, sophisticatedly performed by the technicians as part of their maintenance service for the customer.

Manipulation of digital and physical material
In making sense of the system, the technicians actively engage their skills and experiences through interacting both direct and indirectly with the system.

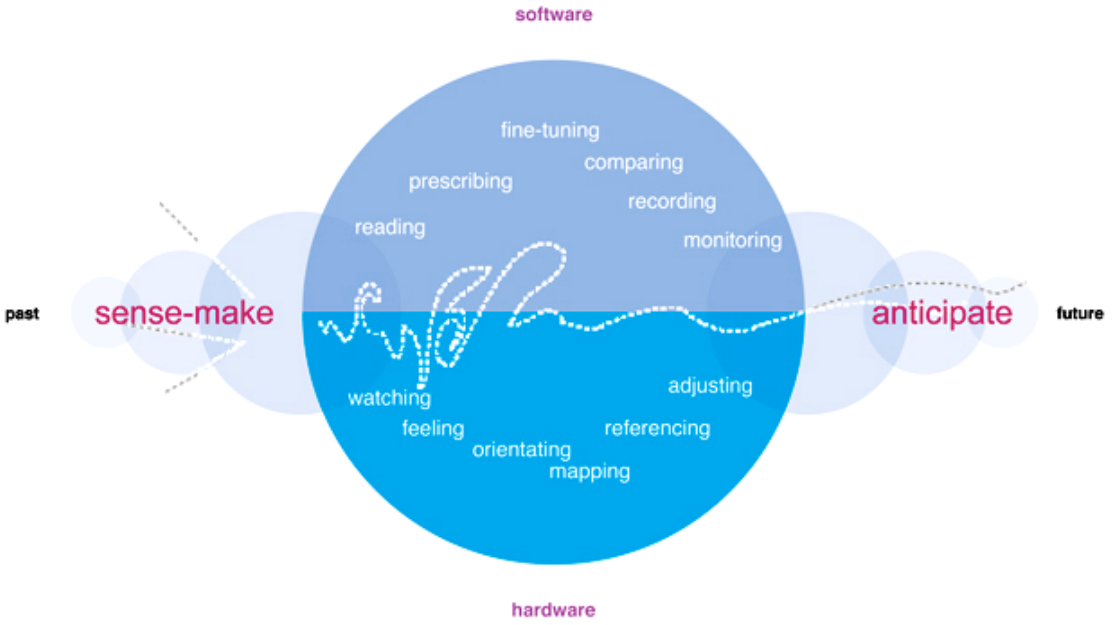

Figure 1. The largest and most centered circle represents a current configuration event. On the horizontal axis, the time dimension is visualized to emphasize how one event of configuration involves making sense of the system and anticipating its optimized settings for the future. The lighter blue represents those activities that are carried through using configuration software, while darker blue are through system hardware.

This indirect interaction with the system can be often challenging since it involves manipulation of numerous kinds of information, which though are represented in digital form, corresponds to the physical and real components of the system (compressor, condenser, evaporators, etc.).

System maintenance through situated learning

In configuring refrigeration system, technicians also anticipate for the ways the system can or should be in the future. The knowledge to configure in this way is gained through the technician's engagement in each configuration events, where they become part of the collaborative making sense of the system and anticipation of its future. It is through such active engagement and direct interaction that the technician's configuration activities become a highly performed and skilled practice.

CONCLUDING DISCUSSION

From our experience in presenting this graphical experience model to other design researchers and students, we learn that the process of modeling is much more engaging and rewarding when it is seen as a process of contributing a part of a puzzle, rather than presenting a picture-perfect description of the field. We see this as an important aspect of experience modeling, since the important notion of representation in this activity is not to report purely objective description of user's work practice [1, 3]. Through various discussions and several iterations of the issues and the ways they are visualized, we realize that much of our design practice becomes more attuned to and sensitized by the user's practice and their experiences. Prior to the presented model in this paper, we have made several changes to the model, mostly as a way to revisit our previous understanding of the practice and finding better ways to describe and visualize the various relations.

This process not only nurtures collaborative efforts among various people in the team, but also critical perspectives towards innovative design practices. In making changes and going through several iterations of various models, a design team would be exposed to the reasons for intricate socio-technical relations of users practice, which are often disguised as unsolved complexities of work. In the next stage of our research, we will further involve our industrial partners in using this experience model to explore other dimensions of user's practice through which design ideas and innovative practices can be generated.

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Strategies for movement-based tangible interaction design

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ABSTRACT
In this paper we present ongoing work in the area of tangible interaction design that finds its basis in human movement. We describe five interaction design strategies that move away from an ergonomic approach for interaction design, and propose to look for the beauty and expressive qualities of bodily movements as inspiration for interaction design. The strategies are illustrated with student work.

INTRODUCTION
In interacting successfully with the world around us, our bodily movements and the perception of movement in our environment are essential [1]. Most of today's intelligent products exploit only a limited part of the extensive repertoire of human capabilities: they require mostly pushing, turning, rotating or sliding. Interaction with these products puts a huge load on people's cognitive skills, not their bodily skills. Humans are however capable of very complex motor actions. Bodily movements and the skill built through performing bodily actions are not only challenging and rewarding, but also beautiful and allow us to express ourselves in a unique way [2].

Consciously designing for human dexterity provides interaction possibilities that are still largely unexplored in intelligent products. In this paper we present ongoing work on both design strategies and interaction designs, inspired by a focus on how interaction with physical objects can exploit man's sophisticated perceptual-motor skills.

DESIGNING WITH A FOCUS ON MOVEMENT
To explore what a focus on movement would mean for interaction design in praxis, we asked second year students of our IT Product Design course to apply different strategies for movement-based interaction design to the design of a new interface for an MP3 player. These strategies were defined by us based on previous research [1]. Together with Mechatronical engineering students they had to build a working prototype, working from one of the given strategies, and test the prototype with users. The prototypes focused on a specific set of functions relevant for investigating the interaction instead the full set of functions. Each team chose a theme to work from. The designs and ideas that are presented in the following should be considered as investigations.

Skills development
The basis for our approach lies in a (re-) appreciation of human motor skills: instead of aiming for products that don't require physical learning, we could actually consciously consider learning specific bodily skills and aim for the challenge and pride that comes with acquiring and possessing motor skills. These are very apparent in such activities as playing an instrument, crafts and sports. This requires thinking in terms of enjoyment of the experience of learning, rather than ease of use [3].

The music database of the 'Swinger' (see figure 1a) can be accessed by swinging the MP3 player's body. Different rotation velocities give access to different genres. The interaction requires control and precision, something that one becomes better at over time. The learning curve the 'Swinger' supports needs to allow novices to operate the product as well as allow for the development of bodily skill.

Flow of Movement
Over time, physical actions and especially a sequence of these actions can become engrained in one's body, something we've called a movement flow [1]. Designing for movement flow requires simultaneous consideration, spatial as well as temporal, of the sequence of required body postures and the type, orientation and positioning of the controls. If the interaction movements have been carefully choreographed, with repetition the user may be able to flow through the required actions with increasing motor confidence, speed and precision.

In a way, this approach leans against ergonomics, yet it is also completely different from ergonomics, as the goal is not necessarily about comfort or the avoidance of pain: it could also be about the expression or beauty of movement.

The movement in-between
This strategy consciously lets go of the direct connection

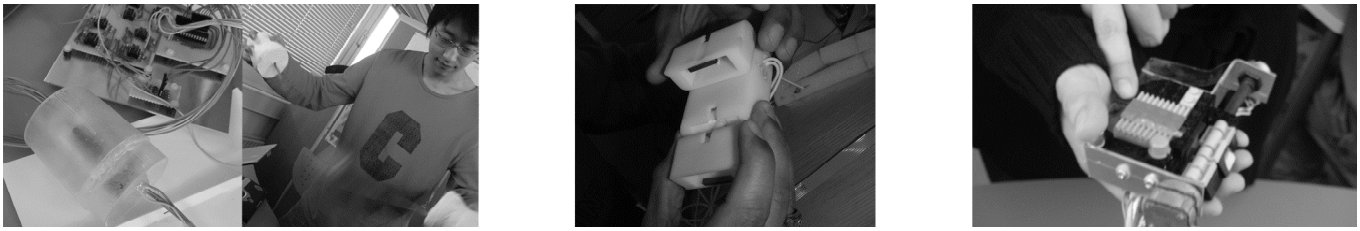

Figure 1. MP3 players: a) the Swinger; b) Flipper; c) Finger-tip-tapper

between action, control and function. In interaction design, only the movement to operate the controls is considered functional, with the movements in between forming time-consuming necessities. A different approach may consider systems that let the movement between the hotspots contribute to the functionality triggered at the hotspots. This changes the movements in between from 'non-functional, but necessary' to contributors to function.

One student group made the comparison to dressage: small adjustments in the rider's position communicate silently which next routine she wants her horse to do. She practices with differences in speed, timing, position etc. to find out which subtle changes communicate which message. A similar approach to movement in intelligent products may encourage the user to build skill as her movements would then improve the quality of the end-result and thus contribute to functionality. A consequence of this approach is that interaction will have to let go of the idea of functionality being of fixed quality. Instead, the quality of the outcome would differ with the user's actions.

Richness of movement

The amount of information that can be communicated through pressing a button is highly limited: on or off. This minimal type of communication is generally a far cry away from the internal complexity of many intelligent products, which call for the adjustments of dozens of parameters.

If we however combine several of such simple building blocks in more complex sequences, it is possible to build meaningful interaction. Flipper (see figure 1b) can be used without looking at it: its different functions are linked to different physical positions the movable parts of the player can be turned or flipped into. Using a combination of both digital and analogue controls, and state-specific actions provide a rich and playful way of interacting with Flipper that looks simple but allows for complex adjustments.

Parallel actions

Another way to increase the input possibilities is to move from controlling a single parameter at a time to controlling multiple parameters simultaneously. In this way, by interacting in parallel with specific building blocks of interaction the number of actions can be decreased.

The music database for the Finger-tip-tapping MP3 player (see figure 1c) can be accessed through different layers at the same time: genre, artist and album. Whilst looking for a specific album takes some time in the beginning and most probably requires individual actions for each parameter, over time the user will become more fluent in operating the three parameters at the same time and develop a physical feel – or motor memory - which position connects to which album. Whilst precision is required to find a specific album, this interaction type also allows for an element of surprise.

DISCUSSION

Before moving on to reflecting over the strategies and their resulting designs, we would like to emphasize again that this is ongoing work. Currently a new group of students is working within a similar but slightly adjusted framework.

Working with the strategies it appeared that students found it difficult to separate them from each other. They often chose to combine two strategies, emphasizing one. Also they investigated other strategies through their designs than consciously chosen in the beginning.

Two strategies didn't result in a final design: 'movement in-between' and 'flow of movement', As already indicated, the first strategy requires breaching the functional link between action and reaction are functionally linked. This might have proven difficult for students who are only in their 2nd year of learning interaction design. Students who started with the second strategy ended up with interaction designs that fitted the 'richness of movement' strategy. This raises the question whether a strategy considering large-scale spatial and temporal issues is particularly suited for the interface design of small, handheld objects.

In the course we focused on small, handheld devices. This has an influence on what can be learned from the resulting designs. Issues such as two-handed interaction or skill building were not investigated since the designs did not support these questions. On the other hand, doing research through actual interaction design allowed for the unexpected to come up. Focusing on working prototypes forced students to work out in detail how the interaction takes place. This resulted in interesting new ways of interaction that provide for further investigations on how movement can be used in tangible interaction design.

ACKNOWLEDGMENTS

Thank you Tom Djajadiningrat and Ben Matthews for the inspiring discussions on this and related work. Thank you, students of IT Product Design for your work in the 2005 version of User Experience Design.

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Sense-Making Methodology: Learn What Users Understand is Important

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ABSTRACT
This paper describes how the Sanse-Making Methodology makes it possible quickly to identify the most serious problems experienced by users of an interface. The paper is based on use of Sense-Making in four different projects and a total of more than thirty interviews.

Author Keywords
Requirements, interview methods, Sense-Making.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Interviewing users is an essential part of learning about their needs. This paper presents a new methodology and how it can be used for interviewing computer users.

I have used the Sense-Making Methodology as inspiration when organizing the paper.

IS SENSE-MAKING TESTED?
Sense-Making has been developed by Brenda Dervin and others since 1972, and it has been used in design of information systems, public information campaigns and marketing [2, 3, 4]. I have used Sense-Making in three industrial software projects and to investigate problems experienced by computers users in Philippines. I have in total conducted more than thirty interviews using Sense-Making.

WHEN IS SENSE-MAKING SUITABLE?
Sense-Making is in particular suitable when the goal is to make a successful improvement of an existing interface or work situation. It can give a reliable description of the biggest problems experienced by users of an interface, and it is faster than contextual enquiry [1] and usability tests. During my own interviews it often took less than twenty minutes before I understood the two or three most serious problems experienced by a user, and experiences from the industrial software projects indicate that if a new interface can solve these problems, the user will consider it a success.

Sense-Making gives a good contact to users and encourage them to talk. The users I interviewed were eager to tell about problems they had experienced. In Philippines I even found that users after the Sense-Making interview felt more free to discuss other aspects of their work.

Sense-Making makes it possible to identify problems that at first appear to have nothing to do with the interface. In one of the industrial projects some users complained about situations where their colleagues had forgotten to note down what they had done. When I later investigated that problem it turned out that the note field in the interface was not designed in an optimal manner.

Sense-Making give a more valid description of possible problems and how they may be solved, than if users are asked to suggest improvements to an existing interface. In one of the industrial projects a group of users had spend a substantial amount of time collecting proposed changes to the system before I did my interviews, and it turned out that only one or two of their proposed changes had anything to do with the situations described in the Sense-Making interviews. However, after the meeting with the users and the leading software designer, it was decided that the upgrade to the system should be based solely on the results of the interviews, not on the list produced by the users.

Sense-Making is not suitable if the goal is to document all steps in a work process, and because it is an interview method, it cannot be used to identify problems that users are unaware of. It is necessary to use Contextual Enquiry [1] or a similar method to identify all steps in a process, and to do a usability test to identify problems that users are unaware of.

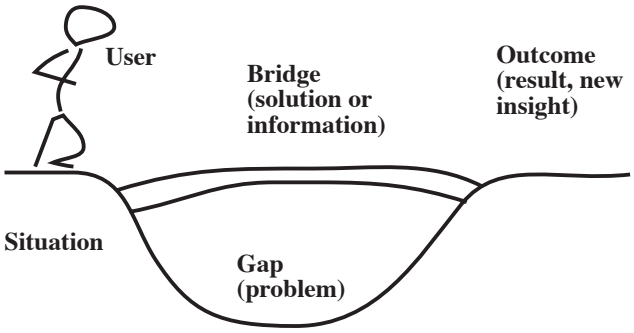

Fig 1: Making sense of a gap and crossing it (based on [2])

HOW IS SENSE-MAKING DONE?

The following is based on my own experiences when using the methodology in user studies.

How to prepare for an interview

It is an advantage to learn as much as possible about the user's domain in advance so the interview can focus on the situations experienced by the user. That was the case in two of the industrial software projects. In contrast, in the third industrial project and in the Philippine study it was not possible for me to learn about the domain in advance, so the users sometimes had to interrupt their stories to explain their terminology and work to me.

It is not necessary to prepare a detailed questionnaire in advance. I found that it was sufficient with a few keywords to remind me of job titles and other basic information that I needed and a small piece of paper listing the steps in my Sense-Making interview.

How to conduct an interview

It is highly advantageous to conduct the interviews at the user's workplace. That is similar to contextual enquiry [1]. In most of my interviews the user had to demonstrate a problem by using his or her daily work tools before I understood it.

In a Sense-Making interview it shall be possible for the respondent to circle and repeatedly engage with the same phenomena [4]. I therefore did what in Sense-Making is called Micro-Moment Time-Line interviews [3]. I first asked the user to describe situations where he or she had faced a problem in the work. When the user had told me about the situations, I asked about each situation in more details: What the user had wanted to accomplish in each situation, what information he or she found useful to solve the problem, and what he or she afterwards believe might have helped to solve the problem.

In some cases it is necessary to adjust the interview method. Users in one of the industrial project and in Philippines started to describe the information and functions they wanted in an interface, even when I asked about situations they had experienced. However, I could then ask about the situations where they had needed the information, and why they had needed it.

Follow-up on the interview

It is important to have a dialogue about the results. In one of the industrial projects I had a meeting with users and the leading software designer. We discussed the problems based on the users' experiences and agreed that three of the apparent interface problems had occurred because of insufficient training, and that the best solution to a fourth problem was to change the work routine and not the interface.

WHAT IS THE BASIS OF SENSE-MAKING?

Sense-Making is a methodology that includes an explicit view of human beings and how they interact.

Each individual is seen as someone who tries to make sense of his or her experiences, and different sense-makings or understandings of the same phenomena are regarded as something that makes it possible to create a more comprehensive understanding. [4]. Therefore Sense-Making stresses the importance of dialogue between different understandings of a situation, and that the user's understanding of a situation of use shall be considered at least as important as the researchers.

Sense-Making focuses on the discontinuities experienced when the individual meets a gap and has to stop and find out what to do next. See figure 1. It tries to determine how an individual experiences that moment, how he or she sees the gap and try to overcome it, and on how he or she progresses after having crossed the gap. [2]. That is why Sense-Making in user studies focuses on situations where the user experiences problems, and on how he or she sees the problems and tries to overcome or circumvent them.

CONCLUSION

Sense-Making has been successfully used, and this paper provides enough information for the reader to start using it.

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Affordance, attention, and time

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ABSTRACT
Two psychological reasons are given for the problems with interfaces in programmed technologies. First the constant shifting of attending to what constitutes the present goal of the perceiver; and second the problem of confusing temporality with sequentiality.

Author Keywords
Affordance, activity, attention, temporality

ACM Classification Keywords
H.1.2 User/Machine Systems, H5.2 User Interfaces, H5.m. Information interfaces and presentation (HCI): Miscellaneous.

INTRODUCTION
Despite the efforts in the field of HCI, a lot of programmed technology still presents difficulties and causes frustration for users without technical backgrounds, and even for some with.

Consider the example of the home video: Video Recorders (VCR) have now existed for more than 25 years, and in all that time it has been a well-known joke that timing your favourite programme was difficult, if not impossible [1]. Now, in my experience, it has in modern hard disk recorders (HDR) become an even more daunting task for any "normal" user. The user is looking between the on screen display and the remote control, desperately trying to find the relevant button for the required interaction, while trying to figure out what went wrong the last time. Of course it helps little that interfaces on videos are similar in function but diverse in form, that is, they can do the same, but to do it you need to do it differently. A frequent solution to this kind of problem is to standardize the diversity of interfaces, however, standardizing a bad design solution does not make it good, it just makes it the only one.

On the other hand there are examples of programmed technology that works well. Consider the example of a good and well-implemented computer game: When playing a computer game (like World of Warcraft), the attention of the player is typically not directed at the level of operation (e.g. W, A, S, D keys in navigating 3D-games) but at interacting with the virtual world (e.g. navigating past obstacles, chasing enemies, running for you life etc.). Only when something goes wrong (like the accidental misplacement of the fingers) is our attention drawn to the keyboard. Programmed technology becomes increasingly complex, and solving the design and interaction problems also becomes increasingly complicated. We need an understanding of how, what and why people do what they do.

FIGURE-GROUND
Gestalt Psychology pointed out in the 1930's that we do not attend equally to everything in the world at the same time. When we look at something it stands out in our conscious attention as the "figure" and what we do not attend to disappear in the "background". The "background" does not cease to exist, it can be brought to the foreground to our attention, and then what was the "figure" will be the "background". An illustration of this can be seen in the ambiguous figure, known as Rubin's vase [2]. Polanyi [3] later called this focal and subsidiary awareness. This description of how we see things in our surroundings has not been ignored in Cognitive Psychology, and is typically seen as a problem of selection. How do we select what to focus on and what not to? The usual cognitive approach has been to see this as a matter of internally based selection criterion, which is then postulated to no end, and unfortunately only exist as hypothetical constructs in theory. I will, instead, suggest that the answer to selectivity is found in our attention to what constitutes the goal for our on going activity, and what does not. Or to put it in another way, what are the levels of activity, where do our conscious attention reside, and what makes it shift?

AFFORDANCE AND LEVELS OF ACTIVITY
"Action is an emergent property of the interaction of three sources of constraint – namely, the environment, the organism, and the task." [4, p.217]. This quote is related to an investigation of the concept of affordance, and shows that the grip configuration in infant reaching depends on not only the object at hand but also the nature of the task. As Bærentsen & Trettvik has shown [5] the concept of affordance only makes sense, at least as it was envisaged by Gibson [6], by relating it to the concept of Activity as found in Leontjev [7]. We concluded that affordance had three

levels or dimensions; the Activity affordance relating to the motives of the organism, the Operational affordance relating to the condition for the organism, and the Action or Instrumental affordance relating to the goals of the *human* agent. This is shown in figure 1.

Figure 1. Three dimensions of affordances. [5, p.59].

THE CONSCIOUS ATTENTION AND HOW IT SHIFTS

The conscious attention is the focal point of our awareness. We are aware of walking down the street, but we do not necessarily attend consciously to it. What we attend to is what is part of our goal structure. If we attend to walking it is because something is wrong with our shoes or the pavement; if we attend to the act of driving it is because the traffic is bad, or something is wrong with the car. Attending to the operational aspect of our activity can of course be a matter of curiosity, but more often than not it is a sign of problems. When we are forced to change focal awareness we are pulled out of the flow of our consciousness. In a somewhat metaphorical way, we can say that it costs energy to shift levels of activity. Sometimes it is warranted, as it turns our focus to the problem at hand, but sometimes it is a problem in it self.

Our consciousness is streaming in time, as William James [8] once said, and this stream or flow of time and how things order themselves can be used to understand the human awareness and the levels of attention.

”The sea of energy in which we live flows and changes without sharp breaks. Even the tiny fraction of this energy that affects the receptors in the eyes, ears, nose, mouth, and skin is a *flux*, not a sequence” [6, p. 240, *italics added*].

TEMPORALITY IS NOT SEQUENTIALITY

Unfortunately, the example of VCR/HDR shows that sometimes the temporal layout of procuring goals is not only marred by shifts of levels of activity, but also of an understanding of temporality as sequentiality. Humans work well at doing things in a certain order, but we do things bad if it has to be in a certain sequence. Order is not sequence, as can be discovered if one analyzes the process of making coffee. Here we have event clusters inside which the sequence of things is interchangeable, and as long as one cluster of events is done before proceeding to the next, the process of making coffee does not require much attention.

CONCLUSION

Users still have a lot of problems with the exceedingly complex programmed technology. Two reasons are given in this text in a very abbreviated form; first, the task is confounded by a constant and forced shift of level of attention; and second, there is a distinct confusion between sequentiality and the order of things, their temporality. A third reason for the problems with the VCR is the mapping between the OSD and the remote control, which is symbolic, arbitrary, and often inconsistent, but that is for another day.

ACKNOWLEDGMENTS

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Increasing the impact of usability work in software development

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ABSTRACT
A key challenge when producing useful and usable software is lack of impact from usability work on software development –and maybe also deficiencies of typical usability work. This paper present a forthcoming CHI 2007 workshop activity where we aim at develop a more coherent and realistic understanding of this challenge, and the possibilities of how to increase the impact from usability work when developing high quality software products.

KEYWORDS
Usability, Case Study, Software Engineering, Software Quality, Organizational Impact, Usability Requirement Management, CHI 2007 workshop

ACM CLASSIFICATION KEYWORDS
D2 Software Engineering - D2.1 Requirements/ Specifications, D2.9 Management; H5 Information Interfaces And Presentation - H5.2 User Interfaces, H5.3 Group and Organization Interfaces; K6 Management Of Computing And Information Systems - K6.3 Software Management, K6.4 System Management

INTRODUCTION
Despite at least 20 years of research into software usability, a significant gap between usability work and software development persists, causing a lack of impact from usability work on software development. This lack of impact is a key challenge when developing high quality software; a challenge that current research has failed to address. HCI-researchers have frequently suggested that research should take into account the work of usability practitioners when doing applied usability research ([5][7] [2] [1] [8] [3]). These suggestions seem to have had limited impact on the research communities. For example, among the usability studies listed in comprehensive reviews like Gray & Salzman [4] and Hartson et al. [6], none is rooted in real-life practices.

We present a CHI 2007 workshop bringing practitioners and researchers together providing an opportunity to analyse and bridge the gap between usability work and software development. The workshop will be based on experiences from practical usability work, and analysing the conditions that influences software development will be the main focus.

Our motivation for presenting the workshop at this symposium is to invite your criticism and advice on how to get the most suitable case studies in order to enlighten the research questions and the issues of the workshop. Also if some of the participants in the symposium are interested in having certain questions described we would be happy to consider your recommendations.

WORKSHOP GOALS
The workshop's goals are:

(1) Establishing and thoroughly discussing a corpus of case studies covering a broad range of experiences with usability work in software development. Focus will be on cases where a significant impact on software product usability has been made or where an expected impact was not realised. The corpus should serve to develop a more coherent and realistic understanding of the conditions that influence the impact from usability work on software development and support exploration of the possibilities to increase the impact when developing high quality software products. The workshop is intended organized as a mutual learning experience, supporting participants both within the industry and the research community in developing ideas and thoughts,

(2) Collecting and publishing a corpus of high quality case studies of rewarding usability work to be used in future research, in teaching and as inspiration to practitioners. The corpus of the case studies is expected to be useful to (a) usability practitioners and software developers as a source of ideas of how to integrate usability work effectively in software development, (b) researchers who seek a more realistic understanding of outstanding research questions and key challenges in usability work in industry, (c) students of HCI courses who want to gain a more complete understanding of how to do usability work in practice.

WORKSHOP ISSUES
We propose four themes and a case study template as a starting point when describing the cases and the participants are encouraged to add additional topics that are relevant to understanding the cases. The goal is not to come up with a

simple prescription, but rather to provide enough structure that contrasting approaches can be explored side by side, while at the same time providing the reader with enough detail to let the reader think about how the particular details of the case influenced its dynamics:

The four themes

Theme 1: "Handling usability as a quality issue in a software development process". Usability of software is one of a number of software quality attributes. Therefore, it seems useful to explore how usability is handled as a part of the software quality management process when designing software and how that influences software development.

Theme 2: "Integrating usability work in a software development process". Two often-mentioned concerns are that usability work is conducted too late in the software development process and that the results from usability evaluations are hard to utilize in software development. Integrating usability work further in software development could diminish such concerns and increase the subsequent impact on software development.

Theme 3: "Situating usability work in an organizational context". Usability work requires organizational knowledge, can depend on organizational involvement, and can motivate organizational changes. Therefore it seems likely that the organizational context could influence how usability work is conducted and how it impact software development.

Theme 4: "Planning, conducting, utilizing and evaluating usability work". Usability work could be organized as a coherent process were requirements are specified, usability evaluations are planned and carried out, evaluation results are utilized in software development, and fulfilment of the requirements validated. Such a structured process could signal seriousness and imply acceptance, and influence the impact on ongoing software development.

The case study template

Section 1: "Setting the stage". This section should describe the industrial context of the software development project, the motivation for adopting usability work and the expected outcome.

Section 2: "Description of the case study". The description of the case study should include a description of the plan and the conducted activities. Furthermore it should describe measurement procedures, contributions from key persons, realized impact on the software development project, and the key challenges in the conducted work.

Section 3: "Different people's perspective on the usability work in the case". This section should encourage the participants to explore and describe how other key persons experienced the outcome of the conducted usability work.

Section 4: "Lessons learned". This section should describe the important lessons learn including which activities that would be repeated in a future project and what would be done differently.

PLAN FOR THE WORKSHOP

Both industrial practitioners and academic researchers are encouraged to participate and hands-on experience from practical usability work is required. The participants are expected to actively take part in goal-oriented group work to establish a corpus of usability case studies to be published after the workshop.

All of the submissions will be discussed thoroughly in the planned group sessions and strengths and weaknesses of the described work will be identified in order to clarify the special contribution from each submission. The discussions should give the participants an opportunity to compare experiences and gain insight, as well as inspire them to further develop clarity and coherence of their case study when extending the submission to a book chapter. In-between results will be retained throughout the workshop to support the future work for the participants and the organizers.

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Keynote Lecture: How to better design things and how to design better things?

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ABSTRACT
We now know that the design of things is important. We see that the decisions we make about the form and behavior of computational artifacts affect how people use them. The HCI community has developed a variety of particular techniques for making better design decisions – studying context and ethnography, participatory design, pattern languages, cognitive walkthroughs, and so on. Still we are far from a systematic understanding that can help us to organize our processes of designing and relate design processes to outcomes.

Education of designers is quite appropriately focused on specific kinds of artifacts: architects learn to design buildings, interaction designers focus on UIs, and industrial designers on products. Yet the focus on domain makes it more difficult for designers to think abstractly about process. Some years ago I worked with N. John Habraken on "Concept Design Games," a project to abstract design process out from specific domains. We used four components – site, elements, rules, and roles – to characterize design processes, and by way of example proposed a series of simple games to illustrate these ideas. The particular games we developed are less interesting than the idea we can understand design processes in ways that are not bound inextricably to specific domains.

Thinking about design processes and systems leads to questions about tools to support designing. On one hand we have quite fancy software to represent the look and feel of designs. On the other hand, our tools for representing the behavior of designs and for managing design processes are still quite primitive. As we advance our understanding of design processes, we can build more effective tools for designers: design tools that capture and convey not only design form but also structure and behavior. The interface design of these tools poses interesting opportunities in its own right — which led me to work on the Electronic Cocktail Napkin, a diagram-recognizing system intended to support designing.

Today, as the worlds of physical and computational artifacts become more and more entangled, again we face the design questions. How can we envision, explore, and evaluate designs in this space of tangible interaction, and embedded and ubiquitous computing? What kinds of tools might help?

And finally, the people dimension! What combinations of skills and abilities will our future designers need? How can students learn to function effectively in this hybrid (and quickly changing) world of engineering, craft, art, and science? What knowledge and experience can we provide to prepare designers for the world they will face?

Keynote address: The Swedish Pirate Party

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FROM THE SWEDISH PIRATE PARTY'S MANIFESTO

"Den tekniska utvecklingen har gjort att Sverige och Europa står inför ett vägskäl. Den nya tekniken erbjuder fantastiska möjligheter att sprida kultur och kunskap över hela världen till nästan ingen kostnad alls. Men den gör det också möjligt att bygga ett övervakningssamhälle av aldrig skådat slag.

På kort tid har övervakningsstaten kraftigt flyttat fram sina positioner i Sverige. Utvecklingen hotar rättssäkerheten, och inget tyder på att den ens ökar tryggheten i samhället. Piratpartiet menar att det här är fel väg att gå. Rätten till ett privatliv är en hörnsten i det öppna och demokratiska samhället. Var och en har rätt till respekt för sitt privat- och familjeliv, sitt hem och sin korrespondens. Om den grundlagsskyddade meddelarfriheten ska vara något mer än tomma ord på ett papper, måste vi slå vakt om rätten till skyddad privat kommunikation.

Argumenten för varje enskilt steg mot övervakningssamhället må låta aldrig så övertygande, men vi behöver bara titta på Europas närhistoria för att se vart den vägen leder. Det är mindre än tjugo år sedan Berlinmuren föll, och det finns gott om andra hemska exempel. Att påstå att bara de som har något att dölja har något att frukta, är enbart historielöst och naivt. Vi har ingenting emot att polisen övervakar och spanar på misstänkta brottslingar. Det är precis vad den ska ägna sig åt. Men att rutinmässigt övervaka vanliga medborgare i hopp om att det ska dyka upp något misstänkt är inte bara en grav kränkning av hederliga människors privatliv. Det är också ett slöseri med värdefulla polisresurser. Vi måste dra i nödbromsen på det tåg som skenar mot ett samhälle vi inte vill ha. Terrorister kan attackera det öppna samhället, men bara regeringar kan avskaffa det. Piratpartiet vill se till att det inte händer."