Good to use!
Use quality of multi-user
applications in the home

by

Mattias Arvola

Good to use!
Use quality of multi-user
applications in the home

by

Mattias Arvola

ABSTRACT

Traditional models of usability are not sufficient for software in the home, since they are built with office software in mind. Previous research suggest that social issues among other things, separate software in homes from software in offices. In order to explore that further, the use qualities to design for, in software for use in face-to-face meetings at home were contrasted to such systems at offices. They were studied using a pluralistic model of *use quality* with roots in socio-cultural theory, cognitive systems engineering, and architecture. The research approach was interpretative design cases. Observations, situated interviews, and workshops were conducted at a Swedish bank, and three interactive television appliances were designed and studied in simulated home environments. It is concluded that the use qualities to design for in infotainment services on interactive television are *laidback interaction*, *togetherness* among users, and *entertainment*. This is quite different from bank office software that usually is characterised by not only traditional usability criteria such as learnability, flexibility, effectiveness, efficiency, and satisfaction, but also professional *face management* and *ante-use*. Ante-use is the events and activities that precedes the actual use that will set the ground for whether the software will have quality in use or not. Furthermore, practices for how to work with *use quality values*, *use quality objectives*, and *use quality criteria* in the interaction design process are suggested. Finally, future research in design of software for several co-present users is proposed.

Mattias Arvola

Good to use!

Use quality of multi-user applications in the home

LINKÖPINGS UNIVERSITET
LINKÖPING
2003

MATTIAS ARVOLA

GOOD TO USE!
USE QUALITY OF MULTI-USER APPLICATIONS IN THE HOME

ABSTRACT

Traditional models of usability are not sufficient for software in the home, since they are built with office software in mind. Previous research suggest that social issues among other things, separate software in homes from software in offices. In order to explore that further, the use qualities to design for, in software for use in face-to-face meetings at home were contrasted to such systems at offices. They were studied using a pluralistic model of *use quality* with roots in socio-cultural theory, cognitive systems engineering, and architecture. The research approach was interpretative design cases. Observations, situated interviews, and workshops were conducted at a Swedish bank, and three interactive television appliances were designed and studied in simulated home environments. It is concluded that the use qualities to design for in infotainment services on interactive television are *laidback interaction*, *togetherness* among users, and *entertainment*. This is quite different from bank office software that usually is characterised by not only traditional usability criteria such as learnability, flexibility, effectiveness, efficiency, and satisfaction, but also professional *face management* and *ante-use*. Ante-use is the events and activities that precedes the actual use that will set the ground for whether the software will have quality in use or not. Furthermore, practices for how to work with *use quality values*, *use quality objectives*, and *use quality criteria* in the interaction design process are suggested. Finally, future research in design of software for several co-present users is proposed.

ACKNOWLEDGEMENTS

CONTENTS

1.
INTRODUCTION

Designing IT for home situations

How can interaction designers assess the goodness of a solution in the middle of the nitty-gritty design work? This thesis is about use quality of information technology (IT) in home situations. The overacting question is why different kinds of IT-systems are good to use or not good to use. Deciding what goodness is in a design situation is a key activity in interaction design, and this thesis tries to do so for IT in the home. The area of human-computer interaction (HCI) has had models of what goodness is for over 20 years, but almost only for the context of work. Today IT is pervasive and ubiquitous in our society, and the models of use quality are finally beginning to crawl out of the office. This thesis provides suggestions of routes to crawl. In order to set the frame of this work, the nature of design and the phenomenon of IT in the home will be described in this first chapter.

1.1   The nature of design

Theories and methods presented in this thesis are to be considered as tools for researching and practising designers. The understanding of their utility must hence be based on an understanding of the nature of designing. Design is an exploration of the conceivable futures of the design situation at hand. To explore means to do something and see what happens. Doing things in the real world is, however, expensive

and potentially dangerous if you do not know what will happen. Therefore designers create a model, in order to be able to conceive and predict the consequences of a certain design alternative (Schön, 1983). This model can be held in the head, but that is difficult for designs that are more complex than a single line. Most often the model is externalised from the head in the form of talk, sketches, graphs, and other things. These externalisations are called design artifacts, since they are artifacts produced during the design process.

Design problems are never given, many of them may be classified as wicked (Rowe, 1987). That means that they are impossible to define. It is impossible to say what the problem really is, it is always disputable and new questions can be posed that reformulates the problem. There are no rules for stopping; the design process can go on forever if the designers do not stop for external reasons like money or perhaps hunger. Finally, a solution to a wicked problem is never correct or incorrect. Other solutions may always be given and they may be as appropriate as the initially suggested solution. It depends on how the problem is formulated.

The designers are in a problematic situation that has to be explored. During this exploration the design problem and its alternative solutions are defined together in a tight coupling (Schön, 1983). Every explorative move that designers make in order to reach a solution affects the problem. The result of this dependency is that the designers create not only a solution to a problem, but also the problem in itself (see Figure 1.1).
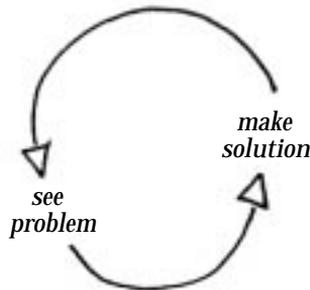
Figure 1.1: The problem-solution loop in design work.

Design is to find the solution *and* the problem in a problematic situation. Or as Winograd (1996, p. XX) puts it:

> "The designer looks for creative solutions in a space of alternatives that is shaped by competing values and resource needs."

So where does the values that Winograd mentions come from? Who's values? Is it the values of the user, the designers, the client or is it the values of society? The answer is all of them. These values are always in competition or negotiation and a continuous dialectic relation between creating and assessing is consequently vital for success in a design project.

Outlining the design process
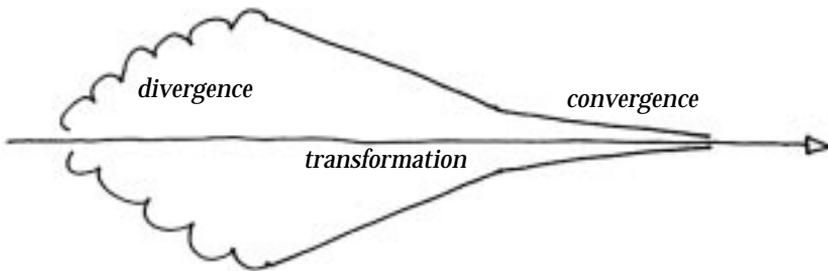
Figure 1.2: The phases of the design process, according to Jones.

A design process has been described by for example Jones (1992) as going from a phase of divergence, over a phase of transformation to a phase of convergence, as illustrated in Figure 1.2. During the divergent phase the constraints and possibilities of the design situation is explored. The designers try to find facts in the design situation that are

stable so that the they can hold on to them in the design process. Large parts of this phase consists of information gathering and trying to understand and formulate the design problem. Alternatives are explored and both impossible and conceivable ideas are tested. The initial visions are formed during this phase. In the transformation phase the number of alternatives are decreasing and the scope of the design is narrowing as the design problem is better understood and the really bad ideas are discarded. Finally, the designers have to take the decision to implement the design in a specification. Jones terms this phase the convergence phase. The changes in the design are in this stage small and the details are being polished.

Jones's outline is similar to Stolterman's outline (Stolterman, 1991; Bratteteig & Stolterman, 1997; and Löwgren & Stolterman, 1998), depicted in Figure 1.3. In his view there are three activities which he names vision, operative image and specification. The three activities are mutually dependent and all present at the same time throughout the design process. But earlier stages of a project carries more of a visionary phase, the middle relies heavier on the operative image and the final part is more dependent on the design specification.
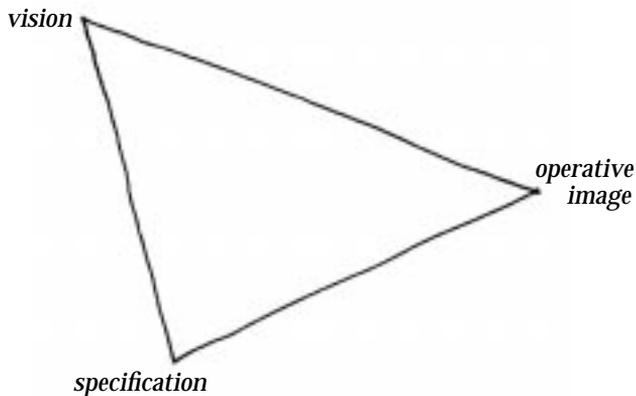
Figure 1.3: The abstraction levels of the design process, according to Stolterman.

Inexperienced designers seem to spend too little time on exploring alternatives, building an understanding and re-framing the problem in a fruitful way. Their divergence is too small. This is risky as they may end up at bad design, since they have not considered alternatives and have not looked around the most obvious solution.

The role of externalisation

An important tool for doing divergence is sketching. Using pencil and paper speeds up the doing-seeing loop of creation, assessment and re-formulation. No other tool is as fast as the pencil and the paper in this respect. Designers can draw a line and immediately evaluate it. This communication process between designer and visualisation of the design situation has another effect: It generates new ideas. As the designers draw, they see their problem in another way, perhaps because a line came out slightly wrong on the paper. Taking a step back or looking at a sketch from a different angle may also lead to new ideas and thoughts. New ideas are then nothing but old ideas in new combinations or old ideas looked upon or interpreted from a new perspective. This is what Laseau (1989, p. 9) means with "a conversation with ourselves in which we communicate with sketches." It is also related to Schön's (1983, 1992) concept of a reflective conversation with the materials of a design situation, where the designer shapes the situation in a way that is in accordance with the initial understanding of it, and then the situation talks back to the designer, who can respond to that back-talk. Figure 1.4 elaborates the problem-solution loop.
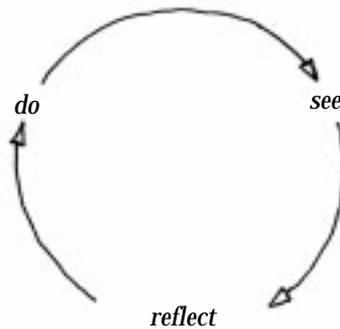
Figure 1.4: Reflection-in-action.

Schön describes in the following way:

> "In a good process of design, this conversation is reflective. In answer to the situation's back-talk, the designer reflects-in-action on the construction of the problem, the strategies of action, or the model of the phenomena, which have been implicit in his moves." (Schön, 1983, p. 79)

The sketches also forms a documentation of the design process without adding any administrative overhead. Designers can learn much by browsing back in old sketches. Schön writes:

> "The drawing can be rapid and spontaneous, but the residual traces are stable. The designer can examine them at will." (p. 157)

Externalisations of different kinds are also used for communication purposes where designers want to present ideas to another member of the design team, to the client, or to a user. The presentation sketches are usually not as rough as working sketches are and their purpose is not only to communicate an idea but may also be to persuade the other part that a particular design alternative is better than other alternatives. Others has previously described different kinds of externalisations in relation to interaction design (e.g. Winograd, 2001; and Löwgren & Stolterman, 1998).

Material–method–problem

Design material, design method and design problem are tied together in a mutual dependency. The design process may start in any of the three seen in Figure 1.5.

Consider the example of an on-line training software for a system. The material is set: HTML and Macromedia Authorware. This controls what the designers can do and what they perceive the problem to be. There are some things the designers cannot even imagine to do. They do, for instance, not consider interactive 3D-visualisation of a database. If it is decided to build a boat in steel, the designers have decided what the problems are: welders are, for example, needed rather than a plastic workshop.
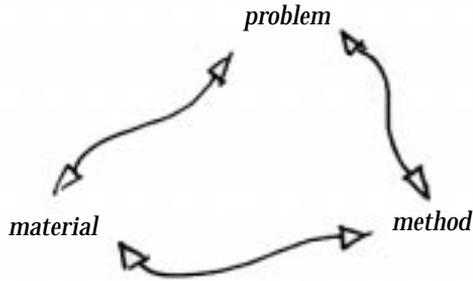
Figure 1.5: The mutual dependency between material, method and problem.

When designers decide which method to use, they also perceive the design problem in a certain way. The method blinds the designers from some aspects and it highlights others. Methods are nevertheless necessary, but in order to get the whole picture the designers must change methods. Otherwise the method is pressed upon the material and the problem and they get locked into being certain things. This has been a problem in much of information system development. The management decide on a method and that is pressed onto the problem and onto the material. It does not matter what the problem is and it does not matter what material the project is working with, they still use the same method (that probably also is trendy). It is, however, irrational to try to use the same development method in web store projects as in space shuttle projects. Doing so would render a documentation process that costs as much as the rest of the development does.

A design method is a way to approach a design problem. In my view, it consists of a complex of techniques tied together by a common, underlying philosophy. Every designer has a repertoire of methods and a repertoire of examples, that make up the experience. The experience is of course tied to what projects the designer has been working on. The examples that a designer has seen influences how design prob-

lems are framed and also embody the designers knowledge of the design material. A designer that has worked only with web projects has a repertoire of examples from the web, but also knowledge in design materials like HTML, Macromedia Flash et cetera. Such a designer is probably not as good at handling traditional widgets and building pop-up windows, and might not even think about how they should be designed or even that they should be designed at all. That designer would instead create a navigation from one screen to another rather than using a pop-up window.

1.2   Interaction design

This thesis is about interaction design, one of the design disciplines. Other design disciplines are architectural design, industrial design, graphic design and so on. To put it simply, interaction design is the design discipline that deals with the design of interactive IT-products. It is a process that under temporal and economical restrictions is managed in order to specify the properties of an IT-product (Löwgren & Stolterman, 1998).

Interaction design is, however also, the design of the use of a system rather than the design of a system per se. It is the design of the actions performed with a product, it is the design of how the product is used in different situations, for example how it is supposed to be used in the school, on the aeroplane, at the office, at home, etc. The interaction design is not over until the practices of using the system and the interaction patterns have settled. The product is designed when it leaves the production line.

The usage of a system consists of users that are doing things with a system for reaching some goals at a certain time and at a certain place. All of these (users, artifacts, actions, goals and context) may be designed or changed in an interaction design process. Even though the focus usually is on designing the systems and the actions performed with them all other aspects of the usage will be affected by the design and are consequently also designed.

I have outlined what the activity of doing design is in this chapter. The reason for doing so is that every theory or method that is to be of any use to practising interaction designers most fit into a designerly work practice and a designerly thinking. It is my goal that the theories

and methods presented in this thesis should function as conceptual tools or tools for reflection for practising interaction designers. Within a moment of reflection there is room for learning.

1.3   IT in the home

The subtitle of this chapter is "Designing IT for home situations," but what is meant by IT in home situations? Our technosphere is becoming increasingly complex, and advanced technology soon penetrates all aspects of our lifes. Our living rooms are turning into infotainment[1] centres, and the home office has been a reality since the eighties (Venkatesh, 1996). More and more homes are being connected to the Internet, not only by the free will of the inhabitants. They are also pushed towards it in the autopoesis of technology. Banks and postal offices are closing down local branches and governmental functions are most easily accessed over the Internet. This is not inherently bad or good, but it poses a number of problems we are only beginning to foresee. It also provides a venture of opportunity for design and design research. The connected home opens up for new interactive services and appliances that we have not seen before.

Just like any other context of use the home and domestic life is socially organised. The activities that take place in our everyday lifes are not confined to the four walls of the houses we live in, just like work activities are not confined to an office and a PC. All human-computer activities (as any other activity) are distributed over time, space and actors which demands increasing mobility of everyday IT. O'Brien, Rodden, Rouncefield and Hughes (2000) showed in their study of a set-top box trial that technology that was fixed at one place in the house caused tension between the householders, since it made harmonious coordination and management of everyday activities in the home more difficult. They also argued for flexibility as an important design consideration in domestic technology. The designers of home IT should also avoid prescriptive models of use, since homes, home life and cultural norms vary tremendously.

---

1. 'Infotainment' is a word created by the combination of 'information' and 'entertainment'.

As IT is used outside work, other values than those of work also enters into our conception of what good IT is. Designers will have to design for different lifestyles, and life-stages. Fashion and symbolism will be more important for consumer products than for working tools. Comfort and togetherness with family and friends will perhaps also be more important than getting things done. Lacohée and Anderson (2001, p. 695) writes:

> "a narrow conception of "user" and "usage" and "usability" will be of little help in understanding how and why people buy, use and dis-use domestic technologies. It has shown how there may be multiple "users" of and multiple "uses" for the same technologies, and that what constitutes usage is defined (or even constructed) by and in a social context."

Tolmie, Pycock, Diggins, MacLean and Karsenty (2002, p. 399) are of a similar opinion:

> "While much of the design vocabulary of the office revolves around tasks, processes, productivity and functionality, the language of the home is often oriented towards lifestyle, aspirations, emotions, aesthetics and so forth. […] [W]e have been motivated by a belief that the radical differences between the home and the office may cause us to re-evaluate many of the assumptions buried in the prevalent views of Ubiquitous Computing. Alternative domains have a habit of challenging consensus and questioning engrained perspectives."

For 20 years the HCI-community has worked with a model of use, users and usability that has been developed for IT at work. As IT-usage leaves the office the HCI-community also has to do so, which leads to the purpose of this thesis.

> *Purpose:* To elaborate the traditional concepts of use, users and usability, by examining the applicability of the concepts outside the office.

It is likely that the desirable use qualities of IT-systems in a home context differs from those that are desirable in a work context. Hopefully, analyses of IT-usage in different contexts can further develop the concepts of use quality and usability.

The core design issues that I would hypothesise to differentiate the home context from the work context are those regarding interpersonal relations. On a surface level, relations between people at home would be more intimate than at work and managing intimate relations would be an important goal. These issues are not as evident, even though they are present to some extent in the work context. Other issues could however also differ between the two contexts of use. In fact, studies of communication technology in American households (Hindus, Mainwaring, Leduc, Hagström & Bayley, 2001) indicate that households are displays on which to imprint the identities of the household members. Households are also sanctuaries where one can rest or play without scrutiny. They also show that family life is the priority, that women handle the household communication, and that the phone was not good enough for getting a good contact with loved ones.

The analyses in this thesis are focused on multi-user applications that are used in a co-present situation. The reason for focusing on systems used by co-present users is that issues of interpersonal relations would be more evident for such systems than for other kinds of systems. Frohlich, Dray and Silverman (2001, p. 721–722) are of a similar opinion:

> "We believe this implies the home PC needs to be more explicitly designed as a multi-user rather than a single-user machine. […] Since the CRT monitor and keyboard is already designed for sit-up use by an individual at a desk, the need from our data is for more relaxed sit back use by individuals or groups."

They highlight individuals or groups that are using systems for social or other purposes, in a relaxed sit-back situation of use. It sounds quite different from a work situation, and will probably lead to that some other design objectives must be used. There is obviously room to question the standard definitions of usability and use quality of software, which leads me to pose the following research question:

Research question: What use qualities can be used to set objectives in design of software for co-present use at home, in contrast to use qualities for such systems at work?

2.
THEORETICAL FRAMEWORK

Design for use quality

The human-computer interaction community has for a long time worked within its own field of practices and knowledge. It has developed in the context of office work, and as the personal computer left the office, most of the HCI-community didn't follow. The Internet was suddenly widespread, personal computers were found in the home, and interactive television was gaining importance in the mid 90's. The market was covered with hand-held computers and mobile telephones were to be seen everywhere. The office was not the only place for IT; it had become an everyday technology.

Still, mainstream research in HCI stood there with old models and old practices not well suited for the new environment. At the same time the new challenges opened the arena for industrial and graphical designers. It allowed new tensions of design considerations to surface and the change was therefore good. Discussions on the practical vs. the aesthetic are in the HCI-community today as common as they have been for 80 years in the industrial and architectural design communities.

The problem in HCI is that we not only honour, but also pay tribute to, the technology of tomorrow. The tribute is the loss of sight of the

old technology and the old models and theories of technology usage. We are blind of the past and our surroundings are blurred as we speed towards the ultimate goal of the better hi-tech society of the future.

Of course, the industrial, graphical and architectural designers have a lot to learn from user-centred HCI-practices but the HCI-community can also learn from the other design disciplines. Kristina Hooper argued this as early as 1986 and so did Pelle Ehn in 1988. The multiple perspectives model of use quality presented in this chapter, is about such a meeting of design traditions and about transcending the narrow scope of the simple usability models.

2.1 Usability: a matter of practical utility

In the seventies and the early eighties usability was commonly stated as "the product will be easy to use" (Tyldesley, 1988). Brook (1986) pointed out that there were many discussions on how to form usability goals during the early eighties. He gave an example on how usability goals could be stated in the development of an office software. The criteria for usability he used were user performance and user attitude, although he also mentioned ease of learning. At the same conference Shackel (1986) proposed his LEAF definition of usability for the first time (LEAF stands for Learnability, Effectiveness, Attitude and Flexibility). To exemplify how to apply the four criteria when setting usability goals he used an electronic mail software package. LEAF is today one of the most common models of usability and is taught throughout the world in HCI-classes. Löwgren gave a similar definition of usability in 1993 with his REAL (standing for Relevance, Effectiveness, Attitude and Learnability).

The main thought within this tradition is that designers approach the situation of use trying to learn what the criteria, e.g. effectiveness, mean for the particular product, task, user and context of use. From that understanding the designers create specific usability goals and measures that can be used to decide whether the goal is reached or not. This is more or less the standard way usability work is taught in HCI-classes at this date (at least at Swedish universities).

The main industry standard of usability today, is the ISO 9241-11 (1998) which defines usability as:

"the effectiveness, efficiency and satisfaction with which speci-
  fied users can achieve specified goals in particular environ-
  ments"

There are close similarities between the ISO standard above and the
values of for example Brook (ibid.) mentioned previously. This is not
very surprising since it is a standard for office work and Brook used an
office software as an illustrative case.

Another, more recent, ISO-standard (ISO/IEC FDIS 9126-1; 2000)
defines usability in terms of understandability, learnability, operability
and attractiveness which leaves us with a similar list of criteria as the
LEAF and REAL models but without the catchy mnemonic.

The ISO 9241-11 definition of usability was later transformed into a
definition of *quality in use*. Bevan (2001, p. 358) writes that in the ISO
14598-1 (1998) quality in use is conceived as:

"the users' view of the quality of a system, and it is measured in
  terms of the results of using the system, rather than properties of
  the system itself."

In the ISO-standards and by Bevan (1999, 2001) quality in use is
measured in terms of effectiveness, productivity and satisfaction, but
in earlier work by Bevan (1995) there are two interesting definitions[1]:

"*Quality of use:* the extent to which a product satisfies stated and
  implied needs when used under stated conditions."

"*Quality of use measures:* The effectiveness, efficiency and satisfac-
  tion with which specified users can achieve specified goals in
  specified environments."

These citations appear together in Bevan's paper but there is a clear
conceptual gap between the two. Stated and implied needs are imme-
diately operationalised in terms of effectiveness, productivity and sat-

---

1. Bevan has in later texts used the term 'quality in use' rather than 'quality
   of use.'

isfaction. The question is whether these are the needs for all systems, all users, all purposes, and all actions in all contexts.

The use qualities effectiveness, productivity, and satisfaction are the consequence of a paradigm of usability engineering and they remained unquestioned axioms for a long time. At first they were developed for office software but are now used for most software. There is an awareness about the context dependence of quality in use but still, the specific use qualities that are used to set usability goals are the same for all systems. There are consequently hidden assumptions in the definitions about the systems, users, purposes, and contexts. To be able to leave the office and set usability goals for IT in the home, these assumptions must be questioned by taking a step back.

2.2   From practical to subjective and social

It is not strange that the de facto standard models of use quality are written the way they are, since the models are derived from usability engineering, and are made for office software. Such a software is fore-most supposed to be practical. The social and aesthetic aspects of the usage are not as important for this kind of product (Hård af Segerstad, 1957).

Most of the almost countless attempts from the research community to set up generic usability goals for software are made from the stand-point of office software. The problem arises when these models are employed uncritically. Usability consultancy firms often use them for any system they design or evaluate, and can then claim, with the authority of the International Organization for Standardization, that they design for usability or quality in use.

Bevan has, as earlier mentioned, stated that quality in use is the quality from the users' viewpoint and accordingly subjective qualities are in focus. That does not suggest that there are no objective practical qualities, nor that they are unimportant. The subjective view on usabil-ity and use quality appeared at first in the late eighties and eventually developed into contextual design as contrived by Beyer and Holtzblatt (1997). The main goal of contextual design is to design systems that match the customers' needs, desires and approaches to work. The cus-tomer is defined as anyone who depends on the system. At the same time there was work going on in participatory design (Ehn, 1988;

Greenbaum & Kyng, 1991; Schuler & Nemioka, 1993) with emphasis on shared understanding, interpretation and cooperation between users and designers. A good historical overview of this development is provided by Ehn and Löwgren (1997).

Winograd (2001) points out that something interesting happened in the early nineties. It was no longer a matter of designing software that was merely useful and economically justifiable, but also delivered rich experiences in use. Within research the meaning of the term 'usability' began to diversify. A deeper understanding of what made an object usable was developed and soon it became important to design not only for effectiveness, efficiency, and satisfaction. Interaction designers should also aim for co-operation, work practices, invisible work, business processes, common ground, knowledge management, professional development, fun, affection, accessibility, customization, localization et cetera. Not all of these use qualities are, however, important design objectives for every system, and to meet them all in one design solution seem most unlikely. In order to handle this diversifying trend for advanced contextual usability a novel framework is needed. The rest of this chapter is devoted to a suggestion of such a framework.

2.3   Towards a model of use quality

In order to say anything about use quality a designer or researcher have to examine the systems-in-use, and make sure that usage or a to-be-designed usage is understood. There are ,however, many ways to study a system-in-use? One way to approach technology usage is the sociocultural view on mediated action, as described by Wertsch (1998).

He argues that the important unit of analysis is the mediated action, that is the irreducable tension between an agent doing something and the cultural tool (or mediational means as he also calls it) that is used. One cornerstone of his view on mediated action is Burke's (1969) notion of the pentad of human actions and motives (see Figure 2.1). He argues in the voice of Burke, that they should be studied by naming the *action* that is being made, and ask what the scene, or *context*,of the action is (the situation in which it occurs and its history). Continue by stating what person or kind of person that is performing the action; who is the *agent.*
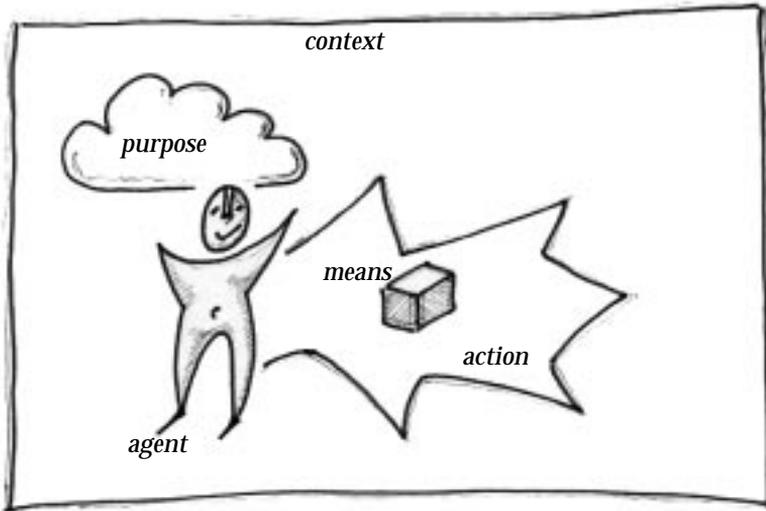
Figure 2.1: A socio-cultural view on the use of artifacts.

After that, ask by what *means* the action is performed, what its agency is. Finally, put the question of why the action is performed, what its *purpose* is.

It is the standard questions you learn in school for writing a good story: What?, Who?, Where?, How? and Why? This sounds all together very simple, but it is a deceptive simplicity. Just because we as researchers or designers of technology state that there is an agent or a scene and name them doesn't make them real. We must question how we set the scene, identify the action and point out an agent. The purpose of an act is often complex or even contradictory and the interpretation of it is not straightforward. The pentad is a tool for interpretation and does not reflect reality as such. It is, for instance, not easy to set the scene (which I also will call context) of an action. It is all the surrounding physical location, culture, history and institutions that affect the action. The setting of a scene takes careful thinking and

experience as well as willingness to change ones mind as new interpretations and other ways of understanding arises.

Mediated action is by Wertsch conceptualised as a system, characterised by a dynamic tension between various elements. In order to understand what is going on in an action one has to study its parts, but still relate the parts to the whole. By viewing technology usage in this way there are similarities to other system views on cognition like modern cognitive anthropology (Hutchins, 1995; and D'Andrade, 1995), activity theory (Cole & Engeström, 1993; and Kuutti, 1996) and cognitive systems engineering (Hollnagel & Woods, 1983; and Woods & Roth, 1988). Within that joint cognitive system, there is an irreducable tension between the agent and the mediational means. This tension is characterised by mastery as well as appropriation. That means that the agent may have the know-how of using a mediational means, but have not appropriated it; made it into ones own. The agent may be very good at using a particular word processor, but does not feel at home with it.

Artifacts are not the product of pure rationality, nor are they the product of whim. They have come into existence as part of culture, history and institution and are thus also associated with power and authority. All of this leads to the conclusion that replacing one cultural tool for another will unavoidably create a new mediated action, qualitatively different from the previous one. In Wertsch's (1998, p. 43) own words:

> "the general point is that the introduction of a new mediational means creates a kind of imbalance in the systemic organization of mediated action, an imbalance that sets off changes in other elements such as the agent and changes in mediated action in general. Indeed, in some cases an entirely new form of mediated action appears."

The purposes or meanings of an action are ambiguous in character. They are often multiple and simultaneous, and not seldom conflicting. In addition, the interpretation of purposes will look differently in the eyes of different actors.

I will in accordance with most of the HCI-literature interchangingly talk about agents in terms of users, and mediational means in terms of artifacts or more precisely as systems. I will talk about purposes in terms of goals and meaning and I will use the term context as synonymous with scene.

A multiple perspectives view on use quality

The question at hand is what happens when the computer is moved out of the practical work domain into a domain where the social and aesthetic functions are more important. Hård af Segerstad (1957) presents what he calls the pyramid of things; he suggests that we can imagine all things in the world in a pyramid. The base of the pyramid consists of the most typically practical things like nuts and bolts, matches, and machines. In this base we can find all tools for work including office appliances. The practical function and utility dominates these objects, but they also have an other trait in common. They can be reproduced almost infinitely without losing their value; they are impersonal and anonymous.

The top of the pyramid would be constituted by the free painting or sculpture with purely aesthetic functions. These pieces are original, unique and personal objects that cannot be replaced. A practical thing from the bottom of the pyramid can always be aesthetisised by taking it out of its use. This is what happens to things in design magazines and at many museums. There is however no clear dichotomy between the top and the base, and objects can in fact be on several places in the pyramid at the same time. A thing for practical use can be beautiful to behold and use, and it may be an object of desire or a symbol of status. There is no contradiction in that.

I would argue that instead of stipulating lists of universal attributes like REAL, LEAF or the ISO-standard, it is more rewarding to take a step back and view the whole use in its totality from different value perspectives, like in the pyramid above. To get a holistic understanding of the total situation of use, the designers have to actively alter between perspectives, looking at the situation from different angles. This may be important when designing for work too, but when entering a novel design situation (e.g. IT in the home) it gets even more important. If the designers do not question the pre-conceptions of what good use quality is, they risk over-generalising their repertoires

of design examples. The purpose of altering perspectives is avoiding that.

Several multiple perspectives models of use quality of IT have been suggested during the last decade (Löwgren & Stolterman, 1998; Ehn, Meggerle, Steen & Svedemar, 1997; Ehn & Löwgren, 1997; and Dahlbom & Mathiassen, 1995). They are similar in thought, perhaps because they all draw heavily on the writings of the antique architect Vitruvius. He held the opinion that good architecture is characterised by strength, utility and grace (Lambert, 1993). A building has to be strong in construction, of practical use, and graceful to the eye.

When describing the use of IT-systems, instead of the IT-systems themselves, Ehn and Löwgren (1997), and Ehn, Meggerle, Steen and Svedemar (1997) present a model for assessment of use quality ("quality-in-use" in their words) consisting of three quality perspectives. They see use quality as a combination of *constructional*, *functional* or ethical, and *formal* or aesthetic qualities. Ehn and Löwgren (1997, p. 309) write:

> "The structure of a system is its material or medial aspects. [...] The functional aspects of a system concerns its actual, contextual purpose and use. [...] the form of a system expresses the experience of using the system."

Further examples of how the Ehn and Löwgren's perspectives can be applied has been presented by Howard (1999, 2002a, 2002b). Elaborating further, Löwgren and Stolterman (1998) use four quality perspectives. The *structure* denotes the construction of an IT-system. *Functional* denotes the working of the system for the actual users in the context of use. *Ethics* denotes the wider effects of the use and misuse of the system, and finally the *aesthetics*, which denotes the aesthetic experience of the system.

Dahlbom and Mathiassen (1995) describe three different aspects of use quality: *functionality*, *aesthetics*, and *symbolism*. The functionality concerns the practical use, the aesthetics are about the subjective experience, and the symbolism is a matter of what the system means and signals to others and ourselves. Löwgren and Stolterman (1998) and Ehn and Löwgren (1997) include the construction of the IT-system as a

quality perspective that has to be taken into account in the design. Dahlbom and Mathiassen does not, instead they prefer to regard it as a part of the functional aspects of the system.

Dahlbom and Mathiassen view use quality in a way very similar to Paulsson and Paulsson (1957). Father and son Paulsson state that it is, in principal, possible to measure the *practical* use quality (functionality) of a system even though it sometimes is difficult to quantify, for example, the goodness of a chair as a tool for sitting. The *social* use quality (symbolism) of a system is not measurable; it's meaningless to say that a certain system is twice as appropriate as another. Social use quality is only valid within a group with similar values. Within a family or other social groups you can, however, say: "We in this group find this car more presentable than that one," or: "We in this group do not care about things like that." The main difference between the practical use quality and the social is by Paulsson and Paulsson considered to be that the former is generally applicable and measurable, while the latter is immeasurable and only valid within a society with common values and a common lifestyle. *Aesthetic* use quality is difficult to assess since it may be very individual. It is, however, common for a social group to have similar ideas of what is beautiful, due to similar background and experiences. Some universals are also considered to exist: An aesthetic object can only be beautiful if it has a pure gestalt[1]. Deciding what a pure gestalt is, is according to Paulsson and Paulsson a skill that can be developed with experience and an open mind.

All of these views on use quality have one thing in common; they are flexible multi-perspective views, which the ISO standards are not. When entering a novel design situation it is necessary to adopt a pluralistic view on use quality, incorporating the beautiful, the appropriate, the practical and the doable. It is preferred to view use quality as multiple quality perspectives both in the interpretation and in the creation of the system.

---

1. For a discussion on and a short introduction to gestalt psychology, see for example Vickers (1979), and Haber and Hershenson (1973).

CONGREGATION OF THE DIFFERENT MODELS

When looking at the different models of use quality presented above it is clear that they overlap and complement each other. I will try to offer a synthesis of the models.

A system can take several different roles or functions in their usage. Three kinds of use are, however, fundamental (echoing Paulsson and Paulsson): the practical use, the social use and the aesthetic use.

The practical use is the usage for utilitarian purposes. There are specifiable goals to be met and it is possible to asses or even measure how well these goals are met. This is what traditional usability engineering and much of informatics is about. To give an example of a word processor: The practical goal might be two write a book, and practical use quality is about how effective and efficient, or easy a user can meet that goal.

Paulsson and Paulsson view it as generally applicable which I do not. The practical value of using a system is always relative to its socio-cultural context, and is also dependent on the goals, needs, skills and knowledge of the agent using the system.

The social use is in which way a system is used in relation to other people. This is a kind of usage with two different faces. The first face shows itself when a system is used in social interaction, when there are several individuals present in the immediate context. The social interaction may in turn be divided into two functions (Wertsch, 1998). On the one hand is the dialogue function where meaning is created in dialogue between the agents of the interaction. In this dialogue there is a spin where thoughts are generated and built upon each other. Systems and other mediational means shape the discourse of such a dialogue. The other function is intersubjectivity. That means that the participants creates a shared understanding of each others meaning, and that the action or utterance of an individual is understood or interpreted "correctly" by another. A system may facilitate this intersubjectivity by functioning as a shared representation or an effective channel or arena for communication.

The other face of the social use is its socio-cultural situatedness (as described by Wertsch). Every system is situated in time and has a history. It looks the way it does because of a number of factors that has evolved over the course of time. It also has conventional or cultural

meanings ascribed to it as a symbol and is used according to traditions and institutions. This also means that it is associated with authority, power and other terms like appropriateness (it may not be appropriate to place a kitchen chair in the dining room).

The aesthetic use appears as Paulsson and Paulsson so eloquently put it "in a moment of contemplation" (p. 75). They see aesthetic use as when the hand strokes over the arm of the chair, when the eye considers the form of a curve on the computer screen or when the ear attends on every shift of tone in a musical piece. The aesthetic use stands in an interesting relationship to the social, since beauty can be said to be in the eye of the beholder and the beholder is always, as previously stated, socially and culturally situated. The beauty of an experience is however not only social and subjective, it also carries objective traits like the ones of a pure gestalt; of harmonies of contrasts and grades. Aesthetics is a kind of properties neither in the subject nor in the object but rather in the relation between the two and has thus both an objective and a subjective character. The aesthetic use is not about beauty. A broken gestalt with disharmony may be ugly and give uneasy feelings, but it is still in an aesthetic use.

I disagree with Paulsson and Paulsson when they state that the aesthetic role is characterised by a moment of contemplation. It is also the unconscious feeling that the use of the system creates, its pace of interaction and the mood of usage experience in its most holistic sense. Moggridge (1999) is of the same opinion; he makes a comparison between a champagne glass and a mobile phone: Both are held in the hand and are lifted to the face, they are intimate and are designed to help the user do something. The champagne glass is designed for the whole experience of using it: How the fingers feel the glass; how the aroma of the wine is contained in and channelled through the glass; how the rim of the glass feels as it touches the lips; and what kind of a sound it makes as it meets another glass. Moggridge means that we can see the mobile phone in a similar way: How it feels to navigate the software of the phone; what messages the system gives to the user; how the other's voice is experienced; and how invisible the infrastructure behind the phone is. It is through the experience of using a system that the aesthetic entirety is realised.
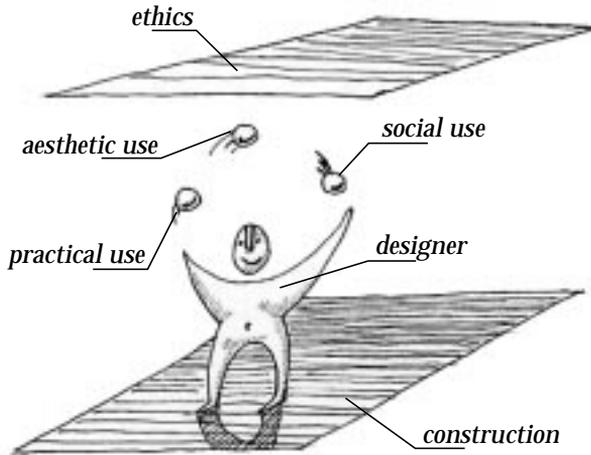
Figure 2.2: The use quality model with the three kinds of use in which the system can have quality, and with the possibilities and constraints of ethics and construction that the designers must handle.

Ethics and moral considerations such as democracy at work have for along time been at the core of participatory design (Ehn & Löwgren, 1997). The question of who wins and who loses on implementing a certain design is central in that tradition. It is the designer's job to think about what kind of a society that is being created through the design, what values that it carries and if the designer would want to be responsible for the effects of putting the product to use. The design of a system might have an impact in a certain culture that it would not have in another due to the prevalent value systems in that particular society. This should be taken into account especially when designing for a foreign market.

The responsibility of the designer is a matter that is open for debate and one could argue whether the engineers in the Manhattan project are to be held responsible for the tragedies of Nagasaki and Hiroshima; if the designers of the Three Mile Island nuclear power plant are responsible for the disaster there, or if designers of Usenet are responsible for the spreading of unwanted material. I believe that they are partly responsible, but not solely responsible. Designers should always think about how the product might be used, misused or abused in a wider context and consider social and human values like freedom of speech, autonomy, privacy, rights to property and accountability. See Friedman (1996 and 1997) and Stolterman and Nelson (2000) for a further elaboration on these matters.

Construction and material considerations are concerned with the material in which we design. In our case, it is the material of information technology. Löwgren and Stolterman (1998) propose that it can be seen as a material without properties. I would agree on that it is a material that is very agile but there are always questions of what can and cannot be done on a certain platform within the constraints of memory size, processor speed and bandwidth. It is a question of how to put the material to best use, while maintaining performance and robustness at a reasonable cost.

There is an interesting thing that makes IT different from other design media. When designing a tool like a photo editor, interaction designers get to design the medium too. They do not only design the tools that can be used on the photo we also design the behaviour of the pixel based image with multiple layers. It is hard to draw a clear-cut line between the tool and the medium; where does the one end and the other beegin? This is a phenomenon that usually arises when the system to be designed is highly complex and dynamic (McCyllough, 1998). This is seldom the case in for example industrial design, and further research on IT as design medium would indeed be interesting reading.

There is, however, one potential problem with the multiple perspectives concerning the material of interaction design. Their origin is in architecture and they do not carry the dynamic properties inherent in the material of IT. Löwgren and Stolterman (1998) recognise this when they talk about forming the "dynamic gestalt" of the IT product. The

dynamic gestalt brings interaction design closer to making film or writing a book, rather than designing a chair or a building. Both the use of the object and the object as such are more dynamic than chairs or buildings are. The perspectives tend to focus the designers' attention on static aspects of the use, but using a piece of technology is never static. Like all action it is an ongoing, dynamic process of seeing and doing (e.g. Neisser, 1976; Ihde, 1979; and McCullough, 1998). It cannot be dealt with or understood in terms of snapshots. This is even more true for IT than it is for more static artifacts. Holmlid (1997) has criticised Ehn and Löwgren (1997) on this account, pointing out that their perspectives do not take into the account the differences between buildings and IT:

> "On a continuum from static to dynamic objects, architecture is by virtue closer to the static end than is system development. On another scale the use of architectural objects in most parts is passive, but in some parts interactive as well as pro-active, while the use of software, by definition, is interactive and pro-active, and only seldom passive." Holmlid (1997, p.14.)

His criticism is as valid for the multiple perspectives described in this chapter as it is for the framework of Ehn and Löwgren. When designing in software, rather than in brick and stone, one must work with the flow of interactions, which means that time and tempo become critical design factors (Redström, 2001).

2.4   Interaction design for use quality

Given that some use qualities to design for has been identified (ease, togetherness, and seduction in the case of iTV infotainment as illustrated in Chapter 5): how do practising designers go about in the process of designing for them?

It is the job of the interaction designers to stand in the middle of the practical, the social and the aesthetic. They have to give form to an object while creating a practical, social and aesthetic usage with acceptable or even exceptional quality in all three kinds of use. At the same time there are constant considerations of construction and ethics: On the one hand, what are the possibilities and constraints of the mate-

rial and the production, and on the other hand, what are the constraints and possibilities of personal, professional and societal ethics.

The kinds of use are not to be seen as complementary, but as perspectives of a whole—the entire use of a system (Holmlid, 1997); a design decision concerning practical use should be considered not only from a practical perspective, but also from, for instance, an aesthetic perspective. It is, as argued above, important to consciously alter between different perspectives when approaching a system-in-use to capture the whole use and not only fragments of it. Consider the following example:

> A car designer may observe that car accidents with deadly outcome are common and decide to do something about it. That decision is an ethical consideration, based on the personal ethical values and on the prevalent value systems in society. The car designer believes that it is vital to listen to these values. One of the reasons for the accidents is the speed of the car. The high speed was initially a social and aesthetic design decision, which now is evaluated from an ethical standpoint. The design solution is an electronically limited speed, at 250 km/h. This is easily evaluated from a practical perspective by measurement. There is no need for further constructional considerations, since it is obviously doable. But 250 km/h is still very fast, and may have to be addressed again as an ethical consideration.

In the example, the practical use, the social use and the aesthetic use of the car are being designed and use qualities are being assessed, at the same time as ethics and construction are considered. The use qualities are speed and safety. The meaning of the use qualities are initially loosely defined and the process of specifying them into assessable design objectives is gradual by necessity, due to the explorative nature of the design process.

The model of use quality presented in the theoretical chapter can be used as part of the ongoing design process. On a high level of abstraction, the design process goes from abstract levels to more concrete levels. The most abstract level is the vision, a more concrete level is the operative image, and finally there is the design specification (Stolter-

man, 1991; Stolterman & Bratteteig, 1997; and Löwgren & Stolterman, 1998). All three levels are present in the entire design process to varying degree, but all three levels are mutually dependent since they inform and delimit each other throughout the design process. The vision is a vague conceptual idea of a possible design that guides the designers in their work; it frames the design problem. The operative image of a design is a communicable externalisation of the vision that is subject to refinements, restructuring, and redefinitions. The design specification is finally the result of the design process where structure, function and form are described in detail as well as plans for implementation in the use context.

The use quality work is part of the entire design process, where abstract *use quality values* that may not even be explicit become part of the initial vision. Use qualities can be identified and shaped into *use quality objectives*[1] that are redefined and negotiated during the formation of the operative image. Concrete *use quality criteria* can finally be defined as part of the design specification.

In order to identify use quality objectives the designers approach a novel design situation by completing the following sentence: "The use of the system should be characterised by…" The result will be a list similar to REAL or LEAF but will be more relevant to the particular system. For a banking system face management and ante-use might be relevant use quality objectives, for an iTV-appliance ease may be a design objective, and for the car example above speed and safety are the most important. At this stage the vision is transforming into an operative image.

It is critical to make sure that all the different uses that the system can be in have been covered. Has, for example, the social use of the system been investigated? The model for use quality, as seen in Figure 2.2, structures this process by reminding the user to think about practical, social and aesthetic use as well as ethical and constructional constraints and possibilities. The result will be a revised list of use qualities, but also a deeper understanding of what the product will be. One must also make sure that the different agents' view on the use qualities

---

1. The use quality objectives have been called other things like abstract usability objectives (Howard 2002a, 2002b), design objectives, client requirements, user needs or product purpose (Cross, 2000).

are really understood. The constituents of a usage, as described in Figure 2.1, are helpful in that process. Every description of a situation of use must include agent, action, means, purpose and context, in order to be complete. Such descriptions are best present and thought about in terms of scenarios of use (e.g. Carroll, 2000). The process of redefining, restructuring and refining the use qualities is part of the work on the operative image.

Several design methods for this process has been suggested throughout the years. One of them is the objectives tree method described by Cross (2000). The procedure he suggests for clarifying design objectives to work towards is to prepare a list of initial objectives with the design brief as a starting point. He proposes that designers must see what implicit objectives underlie the stated ones; what the problem really is. When the list is prepared it can be ordered into higher-level and lower-level objectives and depicted as a tree showing hierarchical relationships and interconnections between objectives. When the use qualities are specified, richly described and their meaning is understood, more specific criteria can be set for the different objectives, which is done as part of the design specification.

When working with explicit use quality objectives the designers can do +/- lists in the midst of the sketches and hence document the rationale for a design decision (choosing one design alternative over another) without any further documentation overhead. This is otherwise a problem with more formal approaches to design space analysis such as QOC (Shum, 1991), which stands for Questions, Options, and Criteria. The Question is a design problem that arises, the Options are the available solutions and the Criteria are the basis for the assessment of the goodness of the different options. QOC overlaps with the work by Carroll and Rosson on claims analysis (e.g. Carroll, 2000; and Carroll & Rosson, 1992). The main difference between claims analysis and QOC is that the claims analysis always is situated in a situation of use, and it provides a process of elaborating the scenarios through a number of "what if questions" which QOC does not. Another difference is that claims analysis does not employ a semi-formal notation, which QOC does.

When the use qualities are specified, richly described and their meaning is understood, specific and well-defined use quality criteria

to design for may be defined. This is made in the design specification. The assessment process of designing is as much part of the entire design process as the creation of the product itself is. As the process of design proceeds, the understanding of what good design is for the particular product also develops. Borrowing two terms from MacLean, Young and Moran (1989): The decision space and evaluation space of design co-evolves.

2.5   In summary

I have in this chapter argued that the traditional HCI perspective on usability and quality in use is biased by a focus on office software. The definitions are taken for granted and applied uncritically. This is dangerous and may lead to poor use quality when leaving the genre of office appliances. The taken for granted model should be questioned by taking a step back, and in every novel design space, posing the question of what use qualities that really are important and meaningful to design for.

It is important for designers to employ a broad and flexible model of use quality, when designing and assessing IT in a novel context. The multiple perspectives view is both broad and flexible, and can contribute to the designers' understanding of different usage situations, including the home.

3.
RESEARCH APPROACH

Ethnographically
inspired design research

The question for this thesis is: "What use qualities can be used to set objectives in design of software for co-present use at home, in contrast to use qualities for such systems at work?" As seen in the previous chapter, use quality always has to be assessed and understood in relation to the context of use and in relation to the community and individuals that are using the system. Co-present use of IT is by definition social to its nature and therefore methods borrowed from the social sciences fit nicely with the research question. I am interested in trying to understand what goes on in such a use and what may make it valuable. It then follows that an interpretative approach to studying use quality is the natural choice for me.

The research behind this thesis is design oriented, even though it has borrowed from ethnography. In this chapter, design research as well as hermeneutics and ethnography, is presented before introducing the overall procedure of the studies. More specific details of procedure is given in the two case studies in Chapter 4 and Chapter 5.

3.1 Design research

Every designer enters a design situation with over-arching theories (Schön, 1983) or in other words a professional vision (Goodwin, 1994) about design.The theories are socially organised ways of seeing and understanding the practice of designing. The professional knowing may be silent or tacit (Polanyi, 1967), but it still guides the moves of the designer. Design research can challenge such theories and open up room for reflection and by that learning.

One way of doing so is to develop and test general laws of human-macine performace, which is appropriate at some times. Another way of doing it is to use speculative design proposals. Speculations marked by questioning curiosity can open a conversation with the stakeholders of a particular product; they can function as probes into values and beliefs of a culture and can be seen as placeholders when exploring a design space. (Gaver & Martin, 2000; Gaver & Dunne, 1999; and Gaver, Dunne & Pacenti, 1999)

> "their overriding function was to serve as landmarks for opening a space of design possibilities for future information appliances. As such, the concepts are *placeholders*, occupying points in the design space without necessarily being the best devices to populate it." [Gaver & Martin, 2000, p. 216]

Around these placeholders or landmarks in the design space the constraints and possibilities for design can be explored. It is perhaps even better if the design speculations are examples of bad design rather than good design, since bad design tends to annoy people and provoke them. When this happens the fabric of our culture becomes visible and we as researchers can see what we otherwise would be blind for. The norms, rules, beliefs and values of the culture can then show themselves for us. Good design tends rather to blend in and become one with the fabric of culture; only slightly bending it.

Mogensen (1992) uses the term *provotyping* to describe a strategy for using provocation in prototyping-based systems development. He sees it as a way of managing how to remain in the tradition of the use practice while still opening space for transcending the tradition in order to overcome ones problems. By provoking users and their prac-

tices one invokes the taken-for-grantedness of that practice and can ask questions of why something is.

Garfinkel (1967) and his followers in ethnomethodology advocates a method that has been called *incongruency experiments* for similar provocations. The idea is that the experimenter behaves in a deviant manner against some norm or expectation in a social setting in order to bring forward the hidden structure of social order. One way of doing so is to insist that friends or family explain the most common and simple utterances, and by that disturb the unquestioned common sense understanding of the actors.

Speculative design research can be made in a similar way to incongruency experiments, by utilising "provotypes." I would argue that first-rate design research and substantial understanding can advance by means of profound speculation. Such speculation without firm grounding in evidence may open room for reflection about how something could be rather than how something is, since it allows something to be seen with fresh eyes by questioning taken-for-granted categories.

Much of the work reported in this thesis is based on scenario-primed and provotyped situated interviews. Users of a technology are confronted with a future scenario by reading a text or by trying out a provotype, and this experience sets the ground for interviews and observations. Gaver and Martin (2000) stress that such provotypes or scenarios need to be open enough for enticing imagination and allowing extensions, developments and modifications. When a design proposal is suggestive about aesthetics and cultural feel, but uncommitted to details of form, function and technical implementation it can extend the concepts beyond the written so that general insights are gained to users' attitudes as well as reactions to specific design considerations.

3.2   Interpretative research

The studies reported in the present thesis were conducted as interpretative design cases. Klein and Myers (1999) state that research is interpretative when the understanding of human sense making is gained through the study of social constructions (for example: language, shared meanings, consciousness, artifacts etc.) as a situation emerges. Much of my view on interpretative research is built on my reading of Klein and Myers.

The design and use of information systems can be seen as a text that we must try to understand (Boland, 1985). It is through a hermeneutic process that we can approach this task and develop an interpretive description of information systems.

At the heart of every interpretative research practice lies the herme-neutical circle, which is the process of always relating the parts to the whole and back again. When a phenomenon is under study every breakdown of it into parts must be put back together again in order to grasp the meaning of it at a higher level of analysis. Anglo-american tradition in science and engineering has always worked on the basis of breakdown, which works fine in natural sciences. Eastern philosophy has always argued that nothing can be broken down to its pieces. Hermeneutics argues that it can be done, but that it must be put back together again in order to understand the interactions between parts in a whole.

In relation to discussions about part and whole one must mention that in interpretative research it is difficult to state where ones object of study begins and ends. There are usually no sharp boundaries or given units of analysis. All constituents of a situation tends to affect every other constituent and therefore one can say that context is king. Since we can only say something about the particular instance and not make generalisations to a general case one must be careful to contextualise the interpretations and the phenomenon under study. The context gives the cues to whether a research result may be transferred to another particular case or not.

Since every observation or interview happens in a cooperative proc-ess between researcher and informants, the relation between the two is vital to understand if one is to judge how reasonable an interpretation of an action or an event is. In every situation there are always several possible interpretations, and sometimes there are several reasonable interpretations as well. These must be accounted for and even sought out actively. In interpretative research one must try to see beyond from what is said and done to what is intended and motivated. It also hap-pens that individual informants have their own agenda and every interpretation that the researcher makes must be respectfully treated with some degree of suspicion.

Furthermore, for qualitative research to be useful to the research community some abstraction of the results must be made. The abstraction is achieved by relating the observations to theoretical concepts and by that contributing to the development of theory or perhaps to understanding what the applicability of a certain concept or theory. In a dialogue with what is known from before and what the researchers observations are, something can be said about the phenomenon at hand and the phenomenon at hand defines and says something about what is previously known. One kind of interpretative research is ethnography. The term has been treated in many different ways so I will here state what I mean by it.

3.3   Ethnography

The subtitle of this chapter states that the method is "ethnographically inspired design research". So what is ethnography? Forsythe (1999) defines it is a research process that uses participant observation, interviewing and document analysis in order to detect consistent patterns of thought and practice and examine conflicts between thought and practice. Ethnography is also grounded in theoretical frameworks for distinguishing between different kinds of knowledge and beliefs in social action. The philosophy behind ethnography is to help researchers take as little as possible for granted about the events and processes that are under study, and promote a "conceptual distance necessary for systematic comparison of multiple perspectives on events and processes" (Forsythe, 1999; p. 129). Forsythe continues:

> "In general, ethnographic fieldworkers do not use preformulated research instruments. Instead, the fieldworker herself is the research instrument, one which is "calibrated" first through training and theory and methodology and then through experience."

The studies reported here are ethnographic to its nature, but the time spent on participant observation was small, instead it relies on interviews and short-period observations as main source of empirical material. A deeper understanding would be developed if the situation

of use could be studied in its own context and within a stream of events and developing interactions (Becker & Geer, 1957).

The problem with interviews is that the ethnographer can not re-affirm an understanding. In a participant observation the informants can point and explain, and expressions are set in natural discourse which allows for better interpretation. Within a long term participant observation there are more cues and more space for negotiation and confirmation of interpretations. There is always the opportunity of coming back and the researcher can point things out that the inform-ants were not aware of as they can be blinded by their taken-for-granted categories.

Situated interviews has been used in the studies reported here, this means that the interviews has been conducted in situ, as events unfold or at least in the same physical context as events inquired into occur. This means that the interview is cued by objects, persons and events that takes place during the interview, and that the informants can point at things and explain what they mean by that.

For some of the studies, interviews and prototypes sessions has been conducted in a simulated home environment. At these occasions the degree of situatedness and participation is of course even lower than in the situated interviews, but the simulated environment reminds the informants and researchers about things they are familiar with. This makes it easier to pretend or create a realistic image of how it would be to use a particular technology in for example their own homes. The temporal contextualisation of the phenomenon under study is how-ever completely lost in this kind of interviews, in comparison to partic-ipant observation, and they can hardly be called ethnographic.

The problem of participant observation is of course availability. It is difficult to get people to allow researchers into their homes for extended participant observation for a long period of time. For reasons of practicality and economy we will have to do with observation snap-shots up to four hours, situated interviews and simulated use situa-tions. In order to view these as ethnographic we must, however, consider some defintitional characteristics of the ethnographic inter-view. A definition is given by Sherman Heyl (2001, p. 369):

"the definition […] will include those projects in which research-
ers have established respectful, on-going relationships with
their interviewees, including enough rapport for there to be a
genuine exchange of views and enough time and openness in
the interviews for the interviewees to explore purposefully with
the researcher the meanings they place on events in their
worlds."

It is evident from the statement above that duration and frequency
of contact as well as the quality of the relationship between the
researcher and the informant is what defines an interview as ethno-
graphic. There must be room for the informants to shape the questions
and the focus of the interview according to their own world-views.
The interpretations must hence be made in relation to the meaning of
the actions and events under study in the actual life-worlds of the par-
ticipants. These key characteristics are what sets ethnographic studies
apart from survey studies.

3.4   Interpretative case studies

The purpose of a case study is to gain knowledge on events in a natural
context. The researcher has therefore no interest in manipulating or
controlling conditions, as often seen in experimental research. Since
the case is one (or only a few), it is important to study the context of the
object of study in order to identify the many factors that can affect the
selected object. Contextual factors are, consequently, seen as resources
in the illustration of the object under study, rather than threats specific
to the case. In collective case studies (Stake, 1994), where several cases
are compared, a conflict may arise between looking for differences or
similarities. It is easier to look for similarities that illustrate a more gen-
eral condition. Differences are more likely to be case specific; a differ-
ence between two cases show that there are differences but does not
say anything about the generalities of the differences. The cases in col-
lective case studies should be chosen on the basis of a belief that under-
standing them will lead to better understanding, or theorising, about a
still larger collection of cases. Stake (1994) named two other kinds of
case studies besides from the collective—instrumental and intrinsic.
The instrumental case study is on the one hand, just like the collective
case study, using a particular case to provide insight into an issue or

refinement of theory. The particular case in itself is of secondary interest. The intrinsic case study, on the other hand, is undertaken because the researcher wants to understand the particular case. The case itself is of interest.

The collective case study that is the empirical basis for this thesis is only to some degree intrinsic in the specific cases. The knowledge interest is mainly the applicability of use quality models and usability models within the domain of face-to-face situations of use. The focus of the studies are therefore on concept building where use qualities have been defined.

A common criticism against interpretative case studies is that generalisation to other populations, situations and persons that has not been studied is very difficult. A reply is given by Firestone (1993): The purpose is not to offer exceptionally good ground for generalisation. Qualitative case studies are best suited for understanding what goes on in a situation and the opinions and understanding that people in that situation have. He is then arguing that the case study is best suited for intrinsic knowledge about the particular case.

However, in order to enhance case-to-case transferability, thick descriptions (Geertz, 1973) are given so that the readers can make their own interpretations of selected parts of the material and judge how well suited the conclusions are for their current case. The reader might find some points for comparison within the cases and the contextual factors will decide if a transfer is possible.

Another kind of knowledge can be learned from case studies. Through the process of abstraction (Klein & Myers, 1999) the particular and unique case is related to theoretical concepts. This process can both show the boundaries of the applicability of a certain concept, and it can also develop the abstract ideas and concepts further by elaborating on subtleties of a phenomenon. The relation to theory in interpretative research is what clearly distinguishes it from anecdotes.

3.5   Overall procedure

In order to answer the research question a co-present situation of use was sought out in a work context. The choice fell on studying software used during meetings between financial advisors and bank customers. That case is a co-present situation of use where advisors and bank cus-

tomers work jointly, and many different computer tools are vital in that work. In particular a bank teller system was studied. Six advisors from six different branches of a Swedish bank were selected. They were followed and interviewed during half a day at two occasions, and field notes were taken and transcribed. During customer meetings the researcher had a passively observing role and just took notes, but after and between meetings there was time for probing questions into what happened during the meeting. These interview opportunities were held in a semi-structured fashion where the researcher had some topics that should be covered. The events that took place during customer meetings did, however, also prompt for elaboration and question. The field notes were brought to the main office where four in-house competence developers and four in-house system developers participated in four interpretative workshops, with the object of answering the question of what the use of the bank teller system should be characterised by. All workshops were recorded on video for later analysis and field notes were taken. Further analysis took place where both the fieldnotes from the situated interviews and from the workshop were analysed for key use qualities of a bank teller system. This study is presented in Chapter 4.

The identified use qualities of the bank teller system had to be compared to use qualities of systems used in a home setting, and three interactive television appliances were studied in design cases. The appliances were designed and tested in order to understand the constraints and possibilities of the design space, and desirable use qualities were identified. The appliances were tested in simulated home environments where use was observed and semi-structured interviews followed after that. In total, 29 informants tested the interactive television appliances and were interviewed. These studies are presented in Chapter 5.

In Chapter 6: Discussion, the two contexts of use are compared in order to answer the research question: "What use qualities characterises co-present usage of IT in a home setting, in contrast to a work setting?" This means that there is an intrinsic interest in the home case and the bank case forms a basis for comparison. The basis should be considered representative for quite a large number of office appliances.

3.6 Analysis

The analysis of the empirical material in the studies presented in this thesis can be described in three mutually dependent, but discernable phases: exploration, transformation, and specification. In general, the process of understanding an object under study went from exploration over transformation to specification, but the process was not that straightforward. Figure 3.1 shows the outline of the analysis.

Figure 3.1: The levels of specificity over time in the process of analysis.

The analysis process was similar to a design process as described by Löwgren and Stolterman (1998). The interpretation and analysis process started when we entered the field and scribbled down the first letter in the field notes. After examining the field notes and listening to, or watching the tapes the initial and tentative categories and definitions were created on basis of a theoretical understanding of the study object. During this *exploration* of the empirical material, a feel for where the empirical material was headed was being developed.

As the empirical material was being processed, created, and moulded, categories or patterns were taking shape. These categories

can be seen as thinking units for understanding what is going on. This was the *transformation* of the empirical material into categories that were merged, removed, splitted up, and so on. A number of different card sorting techniques, such as affinity diagrams (Holtzblatt & Beyer, 1993), were used during this phase.

The final activity was the *specification* of the categories. They were tied back down into the empirical material by use of excerpts from the field notes. At this stage the categories were more concrete, and internal coherence was vital as well as the validation of the interpretations.

This is not a normative model of how analysis of qualitative material should be made, but rather a description of how the research behind this thesis has been conducted. It resembles several other descriptions of the qualitative research process, for example Strauss and Corbin (1990) and Ely (1991).

3.7   In summary

The purpose of the research presented in this thesis is to understand what goes on in co-present use of software and to understand what may make it valuable. It then follows that an interpretative approach to studying use quality is the natural choice of research method. Design research can challenge prevalent theories-in-practice and open up room for reflection and by that learning. One way of doing so is to use speculative design proposals that can function as probes into values and beliefs of a culture.

The thesis is built on interpretative design research and at the heart of every interpretative research practice lies the hermeneutical circle, which is the process of always relating the parts to the whole and back again. The research approach is also inspired by ethnography, by which it is meant that the researcher allows space for the informants to shape the questions and the focus of the study according to their own world-views. The interpretations must hence be made in relation to the meaning of the actions and events under study in the actual lifeworlds of the participants.

Two kinds of knowledge can be gained from this kind of research: Knowledge about the particular may be transferred to other cases, and knowledge about theoretical concepts may be abstracted from the particular.

The overall procedure has been a comparison of two cases of co-present use of IT where the first (the banking scene) sets the ground for the one of intrinsic interest (the interactive television scene). The analysis of the empirical material has taken place in three discernable phases: exploration, transformation and specification.

4.
CASE I

The scene of software in
customer meetings at bank offices

While studying the use of professional software at bank offices, we realized that many situations of use at banks are highly collaborative, particularly during customer meetings, when an advisor for example discusses loans with a customer. Most pieces of software at banks are however, at this date, designed with a single user in mind. At the most, systems enable and encourage distributed cooperation over networks. Banks do not distinguish themselves from most other workplaces in this sense. Too few applications in use focus on the group aspects of their usage, and only a few systems are designed for co-present use.

4.1   Co-present groupware

Benford, Bederson, Åkesson, Bayon, Druin, Hansson, Hourcade, Ingram, Neale, O'Malley, Simsarian, Stanton, Sundblad and Taxén (2000) have labelled this kind of situation of use shoulder-to-shoulder collaboration. Stewart, Raybourn, Bederson and Druin (1998)had earlier coined the term Single Display Groupware (SDG) to denote software that enables such shoulder-to-shoulder collaboration. Stewart, Bederson and Druin (1999, p. 286) later defined SDG more precisely as: "computer programs that enable co-present users to collaborate via a

shared computer with a single shared display and simultaneous use of multiple input devices."

Shared interfaces, shared feedback, coupled navigation, equal control and equal participation are important use qualities of SDGs. These kinds of systems utilise multiple private input and a single shared output. When Shoemaker and Inkpen (2001) designed Single Display Privacyware (SDP) as a direct extension of SDG, they designed for private output, using Personal Digital Assistants, as well as private input and public output. They point out a new design consideration not found in SDG: the tension between private and public information. In other groupware applications, such as company wide shared calendars, the distinction between these has been an issue for quite some time (e.g. Palen, 1999).

SDG and SDP introduce equal control and equal participation to interaction design. A lesser degree of participation leads to situations found with, for instance, interactive television (iTV). iTV-appliances are multi-user applications with a single user in control. One user has the remote control and the others, in the couch, are by-sitters. This leads to design considerations of distribution and sequencing of control. iTV-appliances cannot be called SDGs since they have only one input device, but many of the important use qualities are still the same, for instance shared feedback and coupled navigation. (Arvola & Holmlid, 1999; and Holmlid, Arvola & Ampler, 2000. See also Chapter 5.)

This chapter is about software use in customer meetings where the technology are multi-user applications with single-user control, but where there is no shared feedback, and the customers are not regarded as by-sitters as in the case of iTV. With an even smaller degree of participation they have become indirect users. The conventional way to perceive this category of users is that they ask others to use the system on their behalf (Davis, 1985; and Faulkner, 2000), or that the system is of no interest to them; it is up to the service provider to utilise a system if they want or need to. The customers' use is consequently mediated through a direct user. The traditional customer meeting is a co-present situation of use, but as traditionally designed it carries few of the use qualities of SDG (e.g. no shared feedback, no coupled navigation, unequal control and unequal participation), so what is this situation of use characterised by; what is specific for this situation?

4.2   Software at banks

Bevan (1995) provides a number of evaluations of bank teller systems, or "customer transactions processing systems" in his words, for European banking institutions. In summary, he describes the use of such systems as variable and reactive to the needs of the present customer. Efficiency is important due to the pressure from waiting customers. The usage situation is also characterised by well-defined rules and responsibilities. The results also highlight ease of use, ease of learning, and satisfaction as an overall assessment, and broken down to the sub-scales affect, efficiency, helpfulness, control and learnability. Bevan used a top-down strategy to use quality where his pre-conceived categorisation already had fore fronted effectiveness, efficiency and satisfaction, thus becoming the important qualities. In this chapter I take a step back in order to explore and describe some of the design considerations and use qualities of software in customer meetings. Just as in Bevan's case, the study is based on the use of a bank teller system.

4.3   Setting and method

The collaboration between the research team and the banking group had been going on for five years. At the beginning, the project focused on the introduction and learning of a new word processor, but as time went by it was time for a change in the main systems in the banking group, and one of them was the teller system. For a complete view of the entire project, see Holmlid (1997; 1998; and 2002). This chapter reports on the work from the case study of the teller system, but our understanding of bank work is of course informed by the earlier collaboration with the banking group.

The entire banking group has about 15.000 employees and 7 million customers in Sweden and abroad. It has, in round figures, 600 local branches in Sweden and owns subsidiaries like a fund management company, a mortgage institution, an investment bank, and a finance company.

When studying the use of the teller system at the banking group, we performed situated interviews with clerks at six local branches. They were selected so that small, medium sized, and large branches would be represented. The manager at the local branch asked employees that had not taken an on-line course on the new teller system whether they wanted to participate in our study or not. The reason for choosing

clerks that had not taken that course was that we, as part of the larger project, also developed a new on-line course for learning how to use the teller system (Holmlid, 2002). The clerks worked both as advisors with booked customers and as tellers at the counters with "rushed customers." We followed the clerks for half a day at one or two occasions and took the role of an apprentice, trying to learn more about their work and asking probing questions about the episodes that took place. The researcher was a passive observer during customer meetings and an active apprentice between meetings. We wanted to cover practical, social, and aesthetic use, and ethical and constructional issues, and tried to answer the question of what was important in the use of the teller system; what the use of the teller system should be characterised by. It would have been advantageous to capture the customer meetings on video or audio tape, but Bank secrecy made that problematic, if not impossible.

The transcribed field notes were discussed at four 3-hour long interpretative workshops at the head office. The participants in the workshops had received the field notes in advance and were asked to read them through and mark out interesting passages. There were four in-house competence developers and four system developers participating. All eight participants had long experience from banking. One of us functioned as facilitator, while the other took notes and handled the video camera. We asked the participants at the workshops to complete the sentence: *The use of the system should be characterised by…* The purpose of doing so was to set high-level use quality design objectives. The use qualities that completed the sentence were written down on sticky notes that were grouped and the participants finally labelled the groups in order to create affinity diagrams (Holtzblatt & Beyer, 1993).

Our own analysis of the field notes followed a similar procedure, but was also informed by theoretical reflection and by the interpretations made in the workshops. This mean that the interpretations made by the competence developers and the in-house systems developers also became subject to interpretation and analysis by the research team. We read and re-read the field notes creating categories and tried to say what the use of the system should be characterised by.

Since the customers in the meetings were not interviewed, but only observed, more weight has been placed on the bank clerks and the

interpretations from the competence developers and in-house system developers. This is a weakness in the material but it was however a necessity since the research team wanted to minimise intrusion in the meetings. One option would have been to contact all the customers afterwards but that could had damaged the relationship between the bank and the customers.

4.4   Expected use qualities to design for

Just as in Bevan's (1995) study we learned that the traditional usability criteria or effectiveness, efficiency, satisfaction, flexibility and learnability were important. At the bank, they are dealing with individuals' and businesses' money, and money being the important and also very personal matter that it is in our society, there is a call for accuracy. In order to be efficient, and not keeping other customers waiting, the clerks often have parallel customers on-screen; preparing one customer while waiting for another. They also have parallel tasks during a meeting. One of the users had, for instance, four log-ins and two screens open in the system owned by the subsidiary mortgage institution. These are classical examples of the need for flexibility in the systems.

During the meeting with the customer, advisors as well as tellers switch rapidly between different systems and tools. These tools must be integrated with each other to avoid mistakes and slips. Integrating the tools, making them more accessible from inside the other systems would support parallel work and enhance both the efficiency and the ease of learning due to transfer effects.

Overview was another important use quality of the systems. It can be seen as a means for accuracy and efficiency. From the clerk's point of view, there is a need for overview of actors (customers, colleagues, and competitors), contextual information (the financial situation and business in general), and activities (matter of loans, ending of accounts, buying and selling trust funds, parallel work activities etc.). Poor co-ordination, partly due to lack of overview of what the colleagues are doing, may lead to a need to quickly get an overview of a customer. One of our informants found himself in that situation. He had been on vacation and had a customer booked that he was to advise. Someone else at the bank office had booked the meeting for

him, and since that colleague did not know his complete schedule there was no time to prepare before the meeting. All he had was a name and a civic registration number. There was, however, time to print some papers to get a quick glance at the customer's financial situation. From that analysis he arrived at the conclusion that it had to be a matter of re-binding some loans. He also checked the customer's commitment view and could see the customer's behaviour concerning savings, withdrawals and loans. At the same time he also noticed the "TB4," the profitability of that particular customer. Later on he stressed the importance of not being surprised during the meeting with the customer.

4.5   Quality of what precedes use

Before the actual use of a system, events and activities take place that set the ground for the actual use. These events and activities are the ante-use of the system (Holmlid, 2002). An example from the bank:

> A opens all windows and systems that might be needed during a meeting with a customer. He believes that it is a matter of loans and therefore prepares loan documents and opens windows showing the interest situation. If it would be a trust fund issue he would instead need the B-menu system. This will insure a more smooth use of the systems during the meeting, and reduce the risk of getting surprised when meeting the customer.

   The preparations can be more or less well made; good preparations will lead to a better use quality in the actual situation of use. When it comes to the collaborative aspects a few things might be noticed.

> B gets a customer who wants to make some investments and have heard of something called SPAX [a mixed fund, with papers as well as derivatives]. B turns the screen towards the customer, who wishes to save some in a traditional savings account. "It is wise to keep 1 to 2 months salary as a buffer." B explains the different kinds of SPAX, and the customer can choose between a media-related (TIME) and a IT-related. "Do

you want everything in a SPAX, or parts in a traditional fund and parts in SPAX?" The customer says that he wants only two thirds in a SPAX. "And the rest in interests to stabilise your portfolio? Then the SPAX Worldwide?" The customer asks what he said, SPAX Worldwide? "Yes, two thirds in Worldwide." The customer, a bit irritated says, "OK take SPAX Worldwide."

Even though the clerk turns the screen towards the customer he is keen on keeping the control and the initiative. In this case the argument was that he would not let the customer put all his savings in a SPAX, and that he needed a better-balanced portfolio.

The excerpt below shows how C prepares herself and the customer for a following meeting:

"I would need some advice," the customer says. "I have some forest I am about to sell. Is advice free?" C asks whether the customer has decided to sell. "It is much simpler if you book an advisor in advance." C continues, "Is it a lot?" The customer says that she has a valuation under way. C goes on, "Is it investment advice you want?"

C continues to pinpoint what the customer wants, without giving any direct advice, only preparing herself as well as the customer for what they will be talking about later during the booked advice. She is showing the customer what to expect and what to be prepared for, while at the same time finding out to what degree the customer is prepared for an investment discussion. This particular customer has currently only a savings account, but says that she owned a SPAX several years ago.

Ante-use is, as is obvious from the examples above, more than just preparations. It is also a matter of expectations. When it comes to the implementation of computer systems at the work place one must recognise that the successful ones usually are informally advocated. People talk with their co-workers about the new systems that they encounter. Creating good expectations is important for success. Too enthusiastic users may, however, be disappointed.

A clerk that expects something out of using a tool for work and does not get that, will either be happily surprised or angrily disappointed

(see also Holmlid, 1997; and Holmlid, 1998). An example from the field studies was when a bank branch decided that they did not want to use the on-line training system for the teller system that was on Channel 1 (the intranet) and by that chose not to take part in our research project. They had previous experience from other training software on the intranet that had been perceived as almost useless. Therefore our training system was already used before taken into actual use, and this rendered it useless: First impression lasts.

A similar event took place when the bank introduced a new system for handling loans. Everyone within the bank organisation knew it was a Norwegian off-the-shelf system that was not adapted for this particular organisation. It may be significant that it was Norwegian since Swedes always make jokes about Norwegians and vice versa. A typical joke would be that a Norwegian system simply could not work. The users were, anyhow, critical long before they had seen the system. When it finally was taken into use, nothing worked. The users' worst expectations were met and there was an outcry of annoyance and frustration. Eventually, the system was tweaked to fit the needs of the bank and today it runs fairly well. But, the users still see it as a system from hell.

This means that it is important to introduce a new system with care. If the first training system on Channel 1 had been good we would have had no trouble introducing our's, unless our's was not good. The system has to gain approval from the top of the organisation and be rooted at the bottom. This is a lesson the bank has learned: At the time of writing, a new system, called Advisor's Support, is being introduced. It is a system supposed to structure the customer meeting and be a common resource for the customer and the financial advisor. This system is being introduced to the users by ambassadors at every local bank branch and it is insured that the managers also see the benefits of the system and realise the need for training and competence development.

4.6   Quality of face management

As previously stated it is important not to be surprised in the meeting with the customer, but why is it so? At the bank, they are dealing with

people's money, which is an important and personal matter in our society, so there is a call for accuracy or effectiveness.

Accuracy is, however, somewhat superficial. The advisor, and the bank too, must seem trustworthy and should not loose face. There are routines for making up the cash after closing-time and during back-office work, even though it is extra work, but an error that is made in the meeting with a customer must pass unnoticed, since the advisor or teller otherwise looks like a fool that cannot be trusted with the customer's finances. One of our informants said:

> "It should flow between the systems. You often have to get information from many different places, and suddenly you think: 'Where the hell do I find that information?' That cannot happen in the meeting with the customer. [...] It's about trust!"

This excerpt from the field notes seems at first, to be about accuracy or effectiveness and it is. Focusing at the last line, however, one realises that it also is about face. A similar example:

> B cannot risk any faults, and therefore uses the old B-menu instead of SYNK, especially for shares. A few months ago SYNK bought the wrong share options; all Volvo deals became Vostok deals.

It might be called for a more precise definition of what we mean by face. Our understanding of face is built upon the work by Brown and Levinson (1987) and Goffman (1967). In English as well as in Swedish there is a notion of 'losing ones face'. It occurs when someone is embarrassed or humiliated, and in this metaphorical sense:

> "face is something that is emotionally invested, and that can be lost, maintained, or enhanced, and must constantly be attended to in interaction. In general, people cooperate (and assume each other's cooperation) in maintaining face in interaction, such cooperation being based on the mutual vulnerability of face."
> Brown & Levinson (1987, p. 61)

Brown and Levinson continue by making a distinction between two kinds of face: negative and positive face. The negative face is the basic claim to autonomy, and the positive face is the self-image or self-worth:

> "**negative face:** the want of every 'competent adult member' that his actions be unimpeded by others.

> **positive face:** the want of every member that his wants to be desirable to at least some others." Brown & Levinson (1987, p. 62)

The customer meeting is a joint project set up by the participants (advisor and customers) in which they have to make a joint commitment to get some work done. As in every joint commitment there is a very important issue of face (Clark, 1996). Any act taken by the advisor will affect not only the public perception of the advisor's self-worth and autonomy, but also the customers'. As Clark (1996, p. 317) puts it: "Equity and face appear to constrain all actions that require joint commitments."

One of the most important things for a personal financial advisor is to create a good relation to the customer and set the ground for a joint commitment to do business. For instance, as mentioned above, the advisors wish to be prepared before the meeting so that they are not surprised in the meeting. There are probably several reasons for this, for example that the meeting should run smoothly and efficiently. Another reason might be that the advisor does not want to be surprised by different aspects of the customers' financial behaviour. One advisor said:

> "The customer must never feel that their situation is abnormal, that would make the customer uncomfortable."

A surprised advisor might exclaim something inappropriate in a moment of surprise or without intention express some kind of criticism to the customer. Such behaviour would damage the customer's positive face and create an uncooperative atmosphere. One example of face management in that sense would be:

"When it took such a long time with the print-out, I thought the account had been cancelled correctly. Even though the Electronic Journal did not have an entry that it was cancelled I suspected it had been. But I had to try, try if it was possible to cancel it from another terminal. When I then got the error message I thought 'SIGH, I've got to let the customer go.'"

The present systems in use at the bank inhibit the advisor from creating a good relation to the customer by forcing the advisor to do face-threatening acts. At some stages during the meetings the advisor has to do a lot of input into the system and then the advisor more or less ignores the customer. The following is from the field notes:

At one occasion during the meeting, A excuses himself: "I have a hour-glass…" The customer fills in, "Yes it's working."

Non-attention indicates that the advisor does not care about the customer's face wants. Therefore the advisor threatens the negative face by keeping the customer waiting and the positive face by simply not attending to the customer. The advisor has to make excuses and apologise and by that risk losing positive face in order to keep the equity in their joint project. Computers usually enter as a topic for small talk at these occasions and then the meeting is no longer about business but rather about computers. Wiberg (2001a, 2001b) noticed similar issues in his studies of co-located meetings, where the computer support draw much attention away from the face-to-face interaction. In his studies the conversations completely stopped as soon as the participants in the meetings started to interact with the system. He termed the phenomenon *The divided attention problem*.

4.7   Quality of interaction character

Löwgren and Stolterman (1998) describe different interaction characters ['handlingskaraktärer' in Swedish], based to a large extent on Kammersgaard's (1988) perspectives on human-computer interaction, and Laurel's (1993) concept of computers as theatre. They argue that a computer system may take on different characters and either be a system component, a tool, a dialogues partner, media, or an arena. Janlert

and Stolterman (1997) argue for the need to design systems with consistent character in order to support users' anticipation, interpretation and interaction with complex systems. In their words:

> "A character is a coherent set of characteristics and attributes that apply to appearance and behaviour alike, cutting across different functions, situations and value systems…" (Janlert & Stolterman, 1997, p. 297)

In the studies at bank offices we have seen that the systems always structure the meeting with the customer in one way or the other, and they can take on several different characters in the immediate meeting. In the empirical material, three kinds of characters have been identified. The interaction character may also rapidly shift between the three kinds.

The first kind is *the system as a support.* As earlier noted, the advisor does not like to input a lot of data into the system during the meeting with the customer since it forces the advisor to ignore the customer. The computer is preferred to be secondary and only backing the advisor in the meeting. A question that arises in conjunction with this is what 'work' is at the bank. The clerk sees the work as meeting the customer and building a joint commitment with that customer, but the bank might see it as entering data into the system and getting the customer to sign. The software for those two cases will probably be completely different.

The customer also has a relation to the computer. Sometimes the advisor turns the screen towards the customer to show something or explain. The advisor then sequences the control or distributes it to the customer, similar to the iTV-appliances described in the introduction. One can imagine a believable scenario where the customer points at the screen and says: "Take this and that away. Could you close those accounts?" The customer is then the direct user of the system and the advisor takes on a supporting role. A number of design considerations of secrecy and the tension between private and public become important.

The second character is *the system as a common resource* for both the customer and the advisor. This is the idea of a new system, Advisor's

Support, which is being implemented at offices at the time of writing. This would be a typical SDG as described in the introduction.

The system as a tool was also an interaction character that appeared. During the extensive time spans of data input into the system or when there is a breakdown that takes time, the advisor is forced to ignore the customer who starts looking up into the roof and the advisor must excuse him or herself for ignoring the customer. The meeting is disturbed by the use of the computer as previously described. The computer changes from being a support in the meeting to being a tool for entering data, and the customer is nothing more than a distraction for the advisor. This change in the character of the computer system is nothing exceptional or bad as such, but it becomes a problem when the use of the computer is in this state for too long. The system as tool is for this reason least wanted interaction character during a customer meeting.

4.8   Discussion about IT in customer meetings

At the beginning of this chapter we set out to explore what good use quality of systems in customer meetings is. The results suggest that it is characterised not only by the traditional usability criteria, but also by the ante-use with its preparations and expectations, face management, and three different interaction characters which the system rapidly may change between.

In order to design a system with good use quality in customer meetings, one has to design for good face management and good ante-use, both in the form of preparations and in the form of expectations. One must also consider what interaction character the system primarily should be designed as. How this shall be given form, and taken advantage of in the future, remains a challenge for both design practice and research.

The nature of the use qualities described here will vary between different situations of use. What is considered to be a face-threatening act in a customer meeting at the bank may not be threatening at all in another setting (e.g. a meeting between salesperson and customer). The same goes for ante-use; a good ante-use in one situation may be a terrible ante-use in another (e.g. letting a customer go home and think,

which often is good in bank business, may be bad in some cases for an organisation that tries to sell).

Designing expectations

Considering one of the two forms of ante-use, expectations, it is obvious that the system and everything around it must be designed so that it builds reasonable expectations among the users. This is probably true for all systems and not only systems used in customer meetings. A word processor must follow some genre characteristics of word processors or else it will fail. The reason for this is that if someone tells you that you will get a word processor you immediately will have some expectations of what a word processor is, what functions it should have, and how it should behave. Designers should give the audience what they expect or make them expect what you will give them. To make them ecstatic about the product you must however also give them something more: you have to exceed their expectations (Agre, 1998).

Working with the users' expectations may have an interesting side effect. It may create space for changing the product to the best fit of expectations at the same time as you try to create the best expectations for the coming product. This is what Beyer and Holtzblatt (1997) keep telling us in contextual design.

Designing open systems for collaboration

A design problem that was encountered was how to design systems that do not force the advisor to be rude and make face threatening acts. A solution lies in one of the forms of ante-use, that of preparations for the actual use. For some systems it may be more profitable to design them as process oriented rather than open; more like wizardware. That would of course lead to inflexible systems, but some work tasks are very inflexible. Take handling loans for instance. There are strict routines to be followed and checklists are used for that. Some tasks are also very controlled by regulations and legislation.

A concept for a new kind of system, based on the different interaction characters, is a system that is completely open, like an empty sheet. The advisor would take the white sheet and document the meeting with the customer, and after the meeting execute what they had agreed upon. This would solve the problem of the intrusive system, but it would pose a new problem since they still would have to seek

out information about the customer's account, the interest situation, different unit trusts and so on. The design problem remains to be solved. Another solution would be to design such a system in an object-oriented fashion. The advisor would only have to mark two accounts, and a transaction relation between the objects would be set up and then the advisor would enter the figures for the transaction.

Interesting design implications involve the question whether the bank allows work before and after the meeting, or not. The bank wants the customer to sign at the end of the meeting and no back-office work to be done in order to maximise the time spent with customers. The problem is, as earlier stated; that a lot of data must be entered during the meetings and the advisor is forced to ignore their customers as the divided attention problem the occurs. If the bank to a larger extent tolerated back-office work, then one could imagine an open system that works as a common resource in the meeting with the customers, and a controlled process-oriented system for ante- and after-use. In the ante-use the work is scheduled and after the meeting all data is entered and what has been agreed upon is executed. Designing systems for collaboration in customer meetings is to a large extent a matter of the tension between open and controlling systems and how to assist in maintaining face.

4.9   In summary

Good use quality in customer meetings falls back on face management and politeness. In the ante-use of a system the ground is set for whether an advisor will have to ignore a customer during the meeting or not. A controlling and straightforward system during ante-use may allow for an open and flexible system during the actual meeting and by that leave room for the necessary face work. In the meeting, a system may have the character of a support, a common resource, or a tool. The support or the common resource is to prefer over the tool in a co-present computer supported joint activity, because a tool leads the primary user's focus away from the other participants.

5.
CASE II

The scene of interactive television

Turning from the office to the living room we find a marriage between computers and television. The new media is neither television nor personal computer; it is dynamic and interactive, which television viewing is not and it is based on values of media consumption and socialising, which personal computing traditionally is not. This chapter describes design considerations that we had, and use quality objectives that we tried to meet, in the design of three interactive television (iTV) appliances. It is based on a bottom-up approach to use quality, where the important use qualities to design for are explored and specified from different perspectives of use quality as the design progresses. The chapter is to a large extent based on two articles by Arvola and Holmlid (2000), and Holmlid, Arvola and Ampler (2000).

5.1 Technology issues

The digital broadcast of iTV is received either via terrestrial broadcast, via cable or via satellite. It is decoded by a so-called set-top box, which transforms the digital signals into traditional analogue signals that can be interpreted by the television set. The set-top box is a small computer with memory, processor and so fourth. The hardware places constraints on the design of appliances, since the storing and processing capabilities usually are small, in comparison to modern personal com-

puters. Furthermore, there are serious limitations on storage capacity since many set-top boxes of today do not have hard drives. The executable code and data need to be installed in the flash memory, downloaded via the broadcast or retrieved from the network via the built-in modem. The modem also enables a connection upstream, from the set-top box back to service providers. In addition, there are limitations on the bandwidth downstream, in the broadcast, which means that a large amount of data will cause delay in the appliances. The various systems (satellite, cable and terrestrial) have significantly different bandwidth and delay for data download. Each application must therefore be adapted to the environment it is supposed to be used in.

The most common input device of the set-top box is the remote control. It has numerical keys ranging from 0 to 9, four cursor keys (up, down, left and right), and an enter- or OK-key. It also has a number of function keys. This kind of input device leads to an interaction mainly based on moving a focus over the screen, often in discrete steps. In some cases a full (but small) keyboard may be available too.

High-end boxes are, however, better equipped than this. Their capacity equals that of a modern PC and the storage capacity is no longer a problem. Hard drives are more common and it is believed that it soon will be more economical to record broadcasts on hard drives than it is on VHS-tapes.

5.2   Preliminary genres of iTV

In film theory and mass communication the term genre is applied to any distinct category of products. McQuail (1994) describes genres of products as being identified equally by producers and consumers, by their function, form and meaning. They are established over time and preserve cultural forms, but may also develop within the framework of the original genre. A genre will also follow an expected structure, use a predictable stock of images and have a variant of basic themes. McQuail (p. 263) also states that a genre is:

"a practical device for helping any mass medium produce consistently and efficiently and to relate its production to the expectations of its customers. Since it helps individual media users to

plan their choices, it can also be considered as a mechanism for ordering the relations between the two main parties to mass communication."

In mature fields, such as movies, the conventions are clear. The viewers have developed a good sense of identifying a humorist movie apart from an action movie, and the producers are fluent in the filming language of humorist vs. action movies. Within a genre there are common elements of design that sets it apart from other genres of design.

Genre thinking is powerful in all product design, including interaction design. Within the area of computer and video games there are genres established at this date. Both producers and consumers agree on terms like strategy, adventure, sports, simulation, driving and action, and these genres guide game consumers in their choices and game designers in their work. Löwgren and Stolterman (1998) as well as McQuail (1994) characterise individual products as well as their genres, by describing their use qualities. The framework Löwgren and Stolterman use take a stance in four perspectives; aesthetic, ethic, function and construction, which is similar to McQuail's function, form and meaning.

For the field of iTV, several divisions of genres might be found or constructed. I will distinguish between interactive narrative, on-demand applications and add-ons, when describing different kinds of iTV-appliances.

Other distinctions that overlap, or run in parallel with this might be constructed, such as the difference between informative, functional or leisure appliances. These are not in conflict with the former set, and might function in a complementary manner defining sub-genres such as functional add-ons, or informative on-demand applications.

I have chosen the former set, because it takes the act of viewing television as a whole, instead of breaking it up in different acts. This is more likely to become relevant genres as the social conventions build up over time, and also the kind that the design community should promote instead of a piece-meal chunking of the TV experience. The interactivity needs to be considered in the context of watching TV, with channels, broadcasts, shows etc.

The genre of *interactive narratives* combine narration and interactivity. Described in a fairly naïve sense it allows the viewer to decide or change parts of the narration, the narrative content, or the personage. One could imagine viewers deciding the ending of a drama, choosing the content and depth of different news subjects during a news slot, telling what part of the country they want to view the weather forecast for, or choosing the camera with which they want to view a football game. An interactive narrative gives the viewer the opportunity to individualise content, or to take part as a storyteller. The backside is that there is either a need for more production with broadcast quality, or a radically changed perspective on what a broadcast is. Preliminary, the use qualities of interactive narratives are participation, adaptivity, freedom of choice, and symmetric power balance.

A wide genre of iTV-appliances is the *on-demand applications*, with what seems as obvious sub-genres. They have one thing in common; they are independent of the broadcast, and can be viewed as stand-alone products. Three coarse categories of on-demand applications can be defined. One is the traditional computer applications such as banking, shopping, e-mailing etc. The assumption behind this is to transform the television set into a computer screen; today on-demand applications of this kind try to do things that computers, telephones and grocery stores do better. Another category is guides like electronic program guides, and music channel guides. Yet another category is information applications, such as the traditional text-TV. The main use qualities of on-demand applications are stand-alone, interaction outside the broadcast.

The third preliminary genre of iTV presented here is the *add-on application*. The primary idea behind an add-on is to provide information in parallel with the broadcast. The viewer cannot interfere with the ongoing story. Add-ons neither demand more narrative content, nor broadcast quality micro-episodes. The limitation lies in the need for provision of correct information, in some cases at the very time the events takes place. The main use qualities of a product within the add-on genre are layering, complementary, focus shifting, freedom of choice, and adaptivity.

Mixes between the three genres are also possible such as when users can choose camera (interactive narrative) and/or get statics added on.

5.3   Notes on TV-viewing

Watching television is a social event; according to Gahlin (1989) as many as 73% have company in front of the TV-set. People also engage in side-activities. Gahlin showed that 51% channel surfed extensively, 25% performed other tasks, 21% drank and 7% ate while watching television. This is combined with a broad user group, which in media settings is treated with means and theories collected from mass-communication theory. Theories, which have not yet found their way into HCI-research, although some work is under way (Lundberg, 2001).

   In most cases there is only one remote control, which at a specific point in time is controlled by one person. There are by-sitters that actively participate in the TV-watching and would like to be in charge of the remote, but also by-sitters that wishes not to engage. The usage of iTV is indeed social as people sit together in front of an application in shoulder-to-shoulder collaboration. This is often the case with iTV as seen in Figure 5.1. iTV-appliances have a smaller degree of participation than SDGs and SDPs (described in Chapter 4), since they have single-user control. One user has the remote control and the others in the couch are by-sitters.

Figure 5.1: iTV-appliance in use in a living room.

5.4 IT in the home

Studies of technology in the home indicate several interesting use qualities to design for. It is not all about efficiency and effectiveness that are the use qualities traditionally seen as virtues at work, even though smilar use qualities are important in preparation of food, household maintainence, and tele-work. Households are also displays on which to imprint identity. They are sanctuaries where one can rest or play without scrutiny, and family life is considered a priority (Hindus et al., 2001; Venkatesh, 1996). This also means that there are areas of home life that are personal and other that are public (Junestrand et al., 2001). Flexibility in systems for domestic use is important, since routines and norms differ between and within families (O'Brien et al., 2000; Frohlich et al., 2001; Tolmie et al., 2002; and Lacohée & Anderson, 2001). Gaver and Martin (2000) present IT made for impressionistic and ambient information; diversions and surprises; influence over the environment; intimacy between people; supporting user's insight into their own life-worlds; and mystery and contemplation over the unknown. Future home appliances do not have to be what we today take for granted.

5.5 Method

Speculative design proposals can, as described in Chapter 3, function as probes into values and beliefs of a culture and can be seen as place-holders when exploring a design space. Around these placeholders, constraints and possibilities for design can be explored. In the work reported in this paper 29 potential users of iTV have been confronted with speculative design proposals by trying out a prototype under observation. This experience has set the ground for interviews. The study is an interpretative collective case study, where similarities between the cases are likely to illustrate a more general condition. The cases were chosen because they are dissimilar, but still within the genre of iTV.

   In the three design cases, ideas for design were gathered through an analysis of related existing systems. The iTV-appliances were designed in an explorative fashion where many ideas were investigated in sketches and scenarios. Throughout the entire design process, the designers considered design alternatives in the light of the different use quality perspectives: practical use, social use, aesthetic use, moral

considerations, and material considerations. Ideas where gathered through brainstorming, the resulting ideas and problems were developed a bit further, a new brainstorming was used to get more ideas based on the former ones, and so on. During this phase use quality values were beginning to form that directed the design. When the design space seemed to be as diverged as necessary, some ideas were kept, other ideas were discarded and some ideas were transformed to fit others. At his stage more concrete use quality objectives were developed. This process continued until the finishing solution was implemented in a prototype. The prototypes were tested with users to examine the usage in a simulated, but rather natural setting. These tests revealed a number of conflicts and important concepts to consider when designing a system like the present ones. The experiences from the design process were combined with the results of the user testing to understand the design considerations and use quality objectives. Finally, the results were related to theoretical concepts in order to gain a more abstract insight to what was going on.

5.6   The add-on to a racing broadcast

Interaction designer Fredrik Ampler got a design commission from Telia Research. He was hired to design an interaction model for an iTV-appliance (Ampler, 1998; Holmlid et al., 2000]. He designed the interaction techniques in the context of an add-on appliance, which means that it is downloadedvia broadcasting and added onto a regular television broadcast. The add-on was developed around a Formula 1 racing broadcast, where the viewer was provided with interactive information and statistics on the different drivers and on the race (see Figure 5.2). Telia wanted to explore and investigate problems and opportunities in the meeting of traditional broadcast and interactive content. The objective was to propose an interaction model that integrated essential aspects of traditional broadcast with the ability to reach hyperlinked multimodal information. A more specific goal was to create an understanding of how such an interaction model could be utilized in the development of a Generic Event Application, GEA. The GEA was intended to be a production tool for producers of different events, like sports or an election.
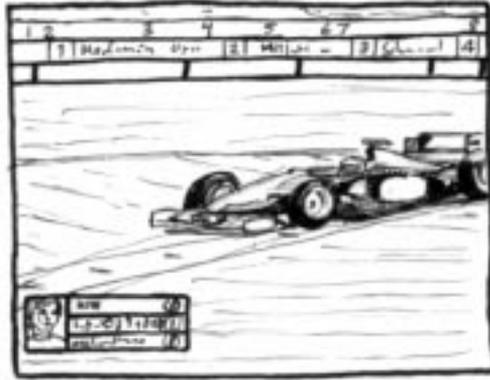
Figure 5.2: Figure 2: Sketch of the racing add-on.

User testing in the racing case

Eleven informants tried out the prototype, eight were men and three were women in the ages of 23 to 30, except one man who was 60. All had significant computer experience. The tests were performed in a corner of a design studio furnished with tables and workstations. It was obviously not somebody's living room, but the environment was arranged to be as close to a living room as possible. The informants sat in a sofa with a table and the television set in front of them facing a wall. The sessions were videotaped and the test administrator took notes. After that the informants answered two questionnaires.

Design considerations of the racing add-on

There is an attention-competing situation in the use where viewers are likely to switch their attention between the broadcast and the interactive layer. They also engage in aside-activities where the attention is divided between the screen and the surrounding environment. Interactive television needs to use *strong visualisations* because there is a broadcast going on in the background. The visualisation of where the focus is on screen will, for example, need to be quite strong in order to be found easily, but if it is too strong it will be annoying when a viewer is not interested in the interactive information. Strong visualisation will also let a by-sitter know what the remote owner is doing.

Users expected to be at ease and the amount of energy and time that goes into learning to use is minimal. If things go wrong in the interaction, actions should be effortlessly reversible. The operation of the appliance and the remote control should be *laidback* and take place without effort. People also expected moving images and *entertainment* when seated in the couch in front of the television set. There should be life in the appliance.

Watching television is a *social* event, with by-sitters unable to control the screen directly. By-sitters would benefit from a good understanding of what the person with the remote control is doing with the system. They will be in a completely different situation of use in comparison to the remote owner. Their situation of use must be considered in the design.

5.7 The on-demand quiz game

On a design commission from Nokia Multimedia Terminals, I designed on-demand quiz game for iTV (see Figure 5.3) with the goal of maximising the social interaction (Arvola, 1999; Arrvola & Holmlid, 1999, Holmlid et al., 2000].
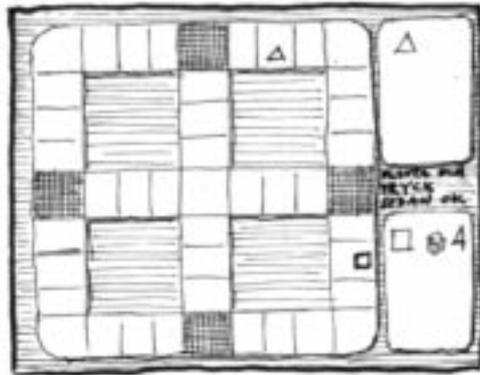

Figure 5.3: Sketch of the on-demand quiz game.

In applications used by co-present groups it is important to give shared feedback, so that users are able to navigate together and see what the others are doing (Stewart et al., 1999). Building on experiences from the racing add-on, I wanted to focus on social interaction like opportunities for confrontation, deception and negotiation. The game was a turn-taking quiz game for two co-present players. The game was built for two players competing against each other. A board was displayed on-screen and the players moved the pieces and answered the multiple-choice questions with the remote control. Two versions were tested: one where feedback only was directed to the remote-owner and one where feedback explicitly told the by-sitter what the remote owner was doing. The remote-owner also received this feedback since it was displayed as on-screen graphics.

User testing in the game case

Eight informants were invited to an office building, where they played the game in pairs in a kitchen while having a cup of coffee and some cookies. The people in the pairs were friends, four women and four men, between 21 and 30 years old. All were university students or academics, and everyone had some experience with computers. The pairs sat by a table in front of a small sized television set and a iTV set-top box. An introduction to the remote control and the game was given before the game started, and the test administrator took notes. The informants played one version of the game for ten minutes and then the other for the same time. After the observation, semi-structured interviews were conducted. The focus of the interviews was on the users' experiences of playing the games, and notes were taken during the interviews.

Design considerations of the quiz game

When the informants played the game, it was quite obvious that an important use quality was *laidback interaction*. That is, the interaction should run fluently and without friction and users should feel at ease. For instance, one player said: "It was troublesome to answer with the numeric buttons, since you had to change the grip or use two hands." Another participant thought that it should be easy to learn and one of them said: "At first, I didn't understand how to do to, for example, throw the dice." When an action was visualised, so that the by-sitter

could see what the remote owner did, it sometimes disrupted the laid-back interaction; it became annoying.

Not surprisingly, *entertainment* is the most important factor in a quiz game. Often-used phrases were: "I want fun out of a game like this," and "quiz games are fun." When the activity is exciting, so that the present activity is all there is, the engagement is high, and the outside world almost ceases to exist; then the participants are more or less seduced. There are three levels of seduction (Khaslavsky & Shedroff, 1999) that can be seen in the empirical material. "It should be pleasant looking at it." This is the first enticing contact with the game on a surface level. One player "would rather play on the PC since its cooler and more evolved." He continued: "Perhaps it would be more exciting if you had never played network games." These statements concern a deeper level of seduction, with a richer experience of the game on an artifact level, where the artifact establishes a relationship with the user. The deepest level concerns more than the experience of the game as an artifact; it is a matter of how the activity of gaming is experienced, the activity level which provides fulfilment. One kind of entertainment comes from the constant news value and the reward for repeated gaming: "I expect mixed categories of questions", "What's good about the game is the good questions. It's the questions that are important. They should be varied", "Most important is that there is a large variation in the questions. There should be a good balance and they should not be faulty". With variation of questions and mixed categories there will be motivation for repeated gaming.

In order for the quiz game to be fun to play there must be both *ego challenges* and *social challenges*. An ego challenge is a challenge of ones competence. Players said things like: "It's fun, a challenge, and it's good for your ego if it goes well." Other examples were: "It's fun answering questions and testing yourself," and "You see if you know anything and you learn." A social challenge is a safe conflict (Crawford, 1982) where the participants can play with roles and challenge each other. Several informants emphasised the competition as a factor of fun. Measuring of strength is, however, not all there is to social challenge. Another aspect is managing complex social interaction in a playful manner. The social aspects are reinforcing factors of the entertainment. One player said the following, regarding playing the game

over a network instead of shoulder-to-shoulder: "You would probably loose the fun of bullying your opponent, giggling wickedly, and smiling satisfied. With that some of the delight would be lost." Yet another player reported: "It was good that you could cheat in the game. That forces you to watch each other."

Closely related to social challenge and the social dimensions of entertainment is the togetherness of the activity. The game needs to promote social interaction and unity the system creates and promotes, and it needs to function as a social lubricator. *Immediate togetherness* is concerned with the social interaction created at the time of the joint activity. When comparing gaming on the screen and on the table, several players said things like: "When you play on screen you don't socialise; instead you look at the screen"; "around a table you have more eye contact with the other players. It leads to more togetherness"; and "everybody sits there, staring at the screen and you're not together in the same way." The game could, however also, promote *delayed togetherness* that took place at a later stage. One player said: "I'd rather have played against people I knew, since it's important to, later on, be able to tease about who won. It's the after-social part of the game." Another player had thoughts along the same line: "It's important to be able to pick on the other afterwards."

5.8   The on-demand news application

Magnus Rimbark (2002) designed an on-demand application for surfing news, after receiving a design commission from the Electronic News Initiative; a project that explores possibilities for the news services of tomorrow. He was hired to design an interface to a local newspaper for a media terminal such as an iTV set-top box, because demographic studies had shown that 38,2% of the readers of Swedish local online newspapers would prefer to use their TV for reading the news (Ihlström & Lundberg, 2002). Since the work in the racing case and the quiz game case had shown that spending time together was important he decided to focus on that and designed the application for co-surfing news by several co-present users. In a pre-study prior to design, where three users were observed surfing jointly with a single remote control, it was observed that much of the talk was about co-ordination of what to read and where to surf, rather than about the

content of the news. There were also difficulties when users used deic-
tic expressions, like 'here' or 'there,' and tried to point at the screen,
since it was four meters away. With that in mind, the application was
designed as a SDG with two game pads for simultaneous input and a
shared television screen for output. The purpose was to distribute the
control and active participation among users, and by that increase
togetherness. Another purpose was to promote laidback interaction by
helping users to use deictic expressions by pointing with the personal
focus.

The prototype also utilized semi-transparent menus and widgets in
order to decrease the possible interference where one person opens a
widget in a way that blocks what another user is doing. Transparency
has been documented to lessen the effect of interference in experi-
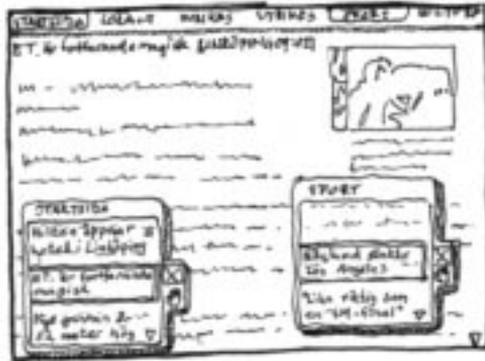ments (Zanella & Greenberg, 2001).

Figure 5.4: Sketch of the on-demand news application.

User testing in the news case

The prototype was tested to find out how users would use the system
and how they would experience it. The informants can all be described
as early adopters (a target group for the client). The users in each test
session were two persons who knew each other well before the test
and who frequently interacted with each other socially. Five test ses-
sions were performed with two users participating in each session.
Two pairs were female users, two pairs male users and one pair had

one person of each. The test sessions were run in an apartment that is specially equipped for testing future home-technology in a home-like environment. Before the users started, a short introduction of the system was given, and the participants got one game pad each. They were then told to start using the system any way they wanted to. The test continued until the users got tired of it, around ten to twenty minutes.

Design considerations of co-surfing news

The use of two input channels was not in itself a solution for engaging the by-sitter and supporting co-operative use. The multi-user styles of use (Scott et al., 2002) that were developed after a few minutes of use were instead based on turn-taking, where one user was active, while the other user was passive. Two input devices during turn-taking does, however, make the distribution of control more equal and the user that would have been passive in a single-control situation is more involved in the interaction.

The optimal outcome of the design that would fulfil most of the design objectives would have been if the users had continuously co-ordinated their actions with the individual input devices in parallel. Both users would have been active and none of them would have become passive or bored. This was not the case.

Interference arose from the shared functions in the system. Users felt annoyed when their news articles were replaced before they had read them, and they felt a sense of guilt when they interrupted the other person's actions. The system may have increased *togetherness* as planned, but it did it at the expense of *laidback interaction*.

The challenge of designing co-surfing application with multiple input and shared screen is therefore to avoid this interference; to increase togetherness while keeping the laidback situation of use. Making this work seems to be difficult in a system like an on-demand news application. The users have to perform activities on the same part of the screen as the other users. When the complexity of the task is too small, one user's actions will come into conflict with the other user's actions since they cannot perform parallel activities on the shared object. In a complex task where both users can perform one subtask each side-by-side without interrupting each other, they can get a substantial feeling of togetherness, since they work on the same joint project. When the task is simple and users have conflicting agendas at

a micro-level, these benefits seem to disappear (see also Stewart et al., 1999).

The prototype utilized transparent widgets and graphics in order to allow one user read beneath another user's personal widget. The logo-type of the local newspaper was as well in a background layer. The transparency worked quite well when the information in the back-ground was simple, such as the familiar logotype. When the informa-tion in the background was complex, as when the article was behind a widget, the users did not bother to try to read through the widgets. Instead they asked the other user to move his or her widget or to hide it. Information such as brand names, adverts, and sponsor-messages with low information content can easily be displayed in a background layer without disturbing the use of the content in the foreground.

5.9 Discussion about iTV-applications

Both similarities and differences can be found in the three cases. Design considerations can, in general, be grouped under three use qualities: Laidback interaction, togetherness, and entertainment.

Quality of laidback interaction

Appliances on iTV need to be easy to learn and give the users a sense of control. The concepts that make up the traditional usability must, however, be treated somewhat differently than the HCI-community is used to do. Users will have to be able to meet their goals, but the goals in a home situation are more opportunistic than they are in a purpose-ful work context (Tolmie et al., 2002). If there is any resistance or fric-tion to use a system it will not be used, because it is not so important. Rather than talking about effectiveness, efficiency, satisfaction and learnability it is more rewarding to see it as laidback interaction. That is a situation of use that is comfortable, carefree, relaxed, easy, and free from labour, embarrassment, or constraint. It is the effortless use of the technology and the fluent interaction with the system without any dis-turbances or friction. One aspect of the laidback interaction is particu-larly prominent in the three cases: strong visualisation.

STRONG VISUALISATION
In all three cases there are examples of the relativity of expressive power of visualisation. In the racing add-on there was a broadcast in

the background, which meant that the visualisation had to be an offset relative to the background, rather than non-intrusive and simple. If the visualisation was too weak it was drowned in the noise of the background broadcast. When having racing cars moving and roaring in the background together with reporters commenting on the race, the feedback visualisation had to be relatively strong to be perceived at all. If it was too strong, however, in relation to the background it became annoying.

This is a design consideration of figure and ground; of perceptual prominence. According to gestalt psychology, when perceiving our environment we look for prominent figures that stand out from the ground[1]. Is it the race that is the important and should be a figure, while the interactive material is a ground, or is it the other way around?

In the on-demand quiz game there was over-visualisation disturbing the interaction. The remote-owner was annoyed with the visualisation that took time and freezed the interaction for a moment. Strong visualisation of actions was, however, useful in critical moments of the interaction. The critical moments were, in that case, when the remote-owner selected topics and answered questions. Then the by-sitter needed to know which buttons the remote-owner pressed. The by-sitter who did not know what the remote-owner answered, could not tease the other for answering stupidly. At other times, there was no need to display exactly what the remote-owner did. Then there was disturbing over-visualisation, which occupied screen estate and delayed interaction.

In the on-demand news case, there was confusion to whether an object should be figure or ground. What if an object was in focus for one user, but in the background for the other user? Semi-transparency was utilized in order to get around the problem, but it was not enough. Only simple information such as logos, or the game in Zanella's and Greenberg's (2001) experiment can be used behind a semi-transparent object.

---

1. Introduction to figure/ground segregation can be found in most textbooks on visual perception, e.g. Vickers (1979), Haber and Hershenson (1973).

Quality of togetherness

The racing case highlighted factors of togetherness between users that were more thoroughly investigated in the quiz game case. The game was used as a social lubricant as described in other descriptions of games as well (Crawford, 1982; Löwgren & Stolterman, 1998; Harris, 1994; Holmquist, 1997). The importance of competing against each other, the ability for family and friends to play together, the social stimulation, and the relationship-centred simulations and explorations have been brought into light. None of previous studies have, however, made a distinction between immediate and delayed togetherness; they are all concerned with the immediate aspect of the concept. When asked to compare playing the quiz game on-screen with playing a quiz game around a table, informants said that they lack the opportunity to see each other's facial expression. Similar issues have been observed in studies of children playing a game on a table vs. playing on a screen. The lack of physical engagement may lead to decreased performance, motivation, and naturalness of the interaction (Scott et al., 2000). In the on-demand news case the goal was to further enhance togetherness, but it was made at the expense of the laidback interaction, as co-ordination difficulties between private and joint activities increased dramatically.

The ultimate object of togetherness as a use quality is socio-pleasure, which is the enjoyment derived from being in the company of others. Jordan (1998) gives examples of coffee-makers that may give an opportunity for gathering, unusually styled household products that attracts comments, and products that defines the owner as part of a social group. All of these are examples of togetherness, both in terms of the immediate aspect and in terms of the delayed aspect.

Togetherness is the state of being together in a group, being in simultaneous contact, and doing things jointly by combined action. A system can promote both immediate and delayed togetherness, as seen in the quiz game. Togetherness is important for iTV-appliances, as also concluded by Hindus et al. (2001); spending time with ones family is what counts as quality time in a home situation.

INTERACTION CHARACTER

In the cases of iTV several different interaction characters (Kammersgaard, 1988; Janlert & Stolterman, 1997; Löwgren & Stolterman, 1998) have been observed. The appliances sometimes switched rapidly

between being a media with content in focus, a tool for carrying out an action without concern of by-sitters, or a common resource that feeds into the social interaction of the users and is used with equal control. The appliances were also used according to different interaction styles. They were switching between being in turn-taking use, parallel use, or mediated use (when one user tells the other what to do).

The results of these studies stand in conflict to the idea that the system must have a consistent character (Janlert & Stolterman, 1997; Löwgren & Stolterman, 1998). People in front of an iTV-appliance will, enter and leave the activity (for example to make coffee), and the sub-goals of the activity may vary as the activity goes on. The goals that the users have in the present situation decide social interaction character and style. When the goals change or when one user has one goal and the other user another goal, the character and style will also change. It also goes the other way around; if the appliance doesn't support a certain kind of character or a style of use, it will hamper the naturalness of their social interaction. Multi-user technology must be flexible enough to handle different interaction characters and styles (Scott et al., 2002). It does seem reasonable to assume that a fluent switching between characters and styles, would allow users to use a system in which way they want, so that they can reach the temporary goals that suddenly appears in an opportunistic activity.

Quality of entertainment

Entertainment is obviously considered to be an important factor in all studies on games. Support for the ego challenge and social challenge can for example be found in Harris' mental and social stimulation, engagement in mysteries, thrilling but safe adventures, and relationship-centred simulations and explorations (Harris, 1994). The constant news value of any iTV-appliance contributes to entertainment and encourages users to use it again. The ultimate goal of the ego challenge in games is to reach psycho-pleasure, which means the pleasure gained from accomplishing something (Jordan, 1998).

Two kinds of entertainment were identified in the game (ego challenge and social challenge), but other iTV-appliences must also be entertaining. In the case of the racing add-on the entertainment comes from the content, and the same goes for the on-demand news. It may

however also come from the socio-pleasure of spending time together and having something to talk about.

A good iTV-appliance should seduce its users. The word 'seduction' comes from Latin, originally meaning an act of leading aside. When something is seducing it attracts, charms, and perhaps even enchants a user. What the users expect to meet will decide if they will be enticed by the product. It will also decide if the user is willing to enter a state of flow or only dismiss the attempt to seduction as foolishness. Flow experiences can have positive as well as negative effects. The positive effects include user satisfaction, increased learning, creativity, and intrinsic motivation. The negative effects are decreased efficiency, over-involvement, or even addiction (Woszczynski, 2002).

Conclusions

Different sub-genres of iTV-appliances will lead to somewhat different use quality objectives to design for. More issues of laidback interaction are important in the racing add-on than it is in the quiz game, and more issues of togetherness surfaces in the quiz game than in the racing add-on. Both togetherness and laidback interaction are, however, significant as seen in the on-demand news, where the concept of a SDG hampered the laidback interaction in an attempt to increase togetherness. Entertainment is equally important in all three, but it is reached by different means. In much infotainment, such as the add-on to the Formula 1 racing and the on-demand news, the content is king. The use value is in the content, and accessing entertaining content in an entertaining, but laidback, fashion is more important than togetherness is. Talking about the content is, however, also valuable.

In the quiz game, laidback interaction is important, but the purpose of it is to enhance togetherness, so that the interaction with the game can become semi-transparent and set the questions and the social interaction in focus instead. The entertaining experience of the quiz game comes from the challenging questions and from the activity of playing with a friend, and bullying and teasing him or her in a playful manner.

Laidback interaction, togetherness, and entertainment are expected to be important in any iTV-appliance, or even in any infotainment appliance used in face-to-face situations. The priority between the use

qualities will, however, differ, as will the means for reaching the use quality objectives in a design solution.

All of the use qualities are connected to each other; they are merely different perspectives of the holistic phenomenon of a system-in-use. In terms of the model of use quality, presented in Chapter 2, all categories are aesthetic quality perspectives and this perspective is dominant in the material. Practical aspects of them are, however, also important, especially in the racing add-on and in the on-demand news. Entertainment and togetherness are functions within an everyday social activity, which is especially prominent in the quiz game application. Strong visualisation and sequencing of control is needed for the design to work in practice. Seen from an ethical perspective there are questions of the goodness of entertainment and togetherness and how they make people relate to and engage with each other. There is also the matter of how to sequence control. Is it only the father in the house that has the remote? From the perspective of construction, it is important to provide a correct and robust high-performance structure that can provide for the functions, the aesthetic experiences and the ethical values associated with them. This is not always easy to do on a digital television platform.

5.10 In summary

Design considerations of interactive television appliances were investigated in an interpretative collective case study consisting of three design cases. Each case included design work and user testing. In total, 29 potential users tested speculative design proposals. The theoretical foundation of the study is a bottom-up approach to use quality. Three high-level use quality design objectives of iTV-appliances are analyzed in detail: laidback interaction, togetherness, and entertainment. These three are expected to be vital use qualities in any infotainment appliance that is intended for use by several users in co-present interaction.

6.
DISCUSSION

Same, same, but different

In this chapter, the desirable use qualities of applications for co-present usage in a home setting, is contrasted to a similar situation in a work setting. It is concluded that it is similar, but also different. Some issues of generalising and transferring the results from the case studies are furthermore highlighted, and a proposal for future research is finally presented.

6.1   Contrasting the scenes

When relating the scene of software in customer meetings at banks offices to the scene of interactive television one can see how they are both different and similar to each other. The patterns of differences and similarities are presented within the framework of use quality presented in the Chapter 2. The use qualities presented in the previous chapters do not clearly *belong* to a single kind of use or kind of consideration. The terms used in the model of use quality are not categories; they are rather aspects of a total usage. This is why it is important to actively alternate between the different perspectives. Every specific use quality can be seen from either a practical, social, aesthetic, moral or material standpoint.

Practical use

At the bank, on the one hand, there is work to be done. Traditional usability issues such as efficiency, effectiveness, parallel work, tool integration, robustness, and overview are important in order to avoid keeping customers waiting, and in order to obtain accuracy. Users also wanted to get started working with the systems soon after introduction, and learnability is hence an important factor. The systems used in customer meetings must also be flexible so that the advisor and the customer can use them in different ways depending on their current goals. One way of increasing flexibility is to allow for easy switching between interaction characters so that the systems can be a tool in one second, and a support or a common resource in the next. Figure 6.1 depicts the interaction characters and styles of use that the systems, at the bank and in the livingroom, has been seen to switch between.

In order to get a smooth running customer meeting the users at the bank did a thorough amount of preparations. They wanted to know what to expect so that they were not surprised. The ante-use was hence fairly elaborate.

In the living room, on the other hand, it is not important to get work done. The use situation is relaxed and laidback, and therefore iTV-appliances must be easy to handle and learn. The goals seem to be more opportunistic in a home setting than they are in an office setting (see also Tolmie et al., 2000), and users don't *have* to use a particular system. They will therefore just let it be if it there is friction in the usage. The situation of use should be comfortable and care free. Ideally there is no labour; just relaxation and laidback interaction.

Diverse user groups in the home make is difficult to know who to design for. Mass communication techniques may, however, help in identifying key characteristics of the use population (e.g. Ihlström & Lundberg, 2002). Personalisation may be another way to approach the problem, but since people enter and leave the activity in front of the television set one must be careful. This will cause a change of individual users, and interaction character of the system as well as interaction style. Flexibility is therefore as important in the home as it is in offices. As seen in the case of the no-demand news, for example, a particular style of interaction should not be imposed on users since it may seriously hamper the co-ordination of personal and joint goals between the users.
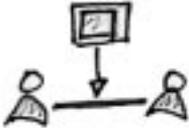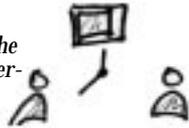
Software as a tool. The software interaction is in focus and the social interaction is secondary.

Software as a support. The social interaction is in focus while the software interaction is secondary.

Software as a common resource. The social interaction is in focus while the software feeds that interaction.

Software in turn-taking use. Either the software interaction, or the social interaction can be in focus.

Software in parallell use with equal control. Both the software interaction, or the social interaction can be in focus.

Software in mediated use. The by-sitter is telling the remote-owner what to do. Both the software interaction, or the social interaction can be in focus.

Figure 6.1: Identified interaction characters and styles of use of software in face-to-face situations.

Since the use of iTV-appliances is a social event with several people in front of the screen, strong visualisation is important. Visualisations must be prominent to the background of moving pictures and designers must resolve what happens when one user's figure is the other user's ground if their personal goals are different at a certain time.

What can be considered use quality in a particular situation is dependent on the the flow of actions within a situation of use; the ante-use of a particular system. The studies in this thesis do not provide a comprehensive answer to what this consists of in home situations, but it is clear that it is important to design the expectations of the users of both banking applications and iTV-appliances. It is also clear that the activities that takes place within a home takes on more of an opportunistic character, than it does at the bank, and given a careful case-to-case transfer, one can suspect that the less preparations and planning that are necessary before the use of an iTV-appliance the more successful it will prove. Tolmie et.al. (2002) provide some interesting findings on how routinised domestic life is and they argue that it is the glue that holds everyday life together. In the home all the disparate priorities of different family members have to be coordinated and without routines this would require much effort. Further observational material would, however, be need in order to say anything substantial regarding this matter in relation to ante-use.

Social use

Togetherness is the state of being together in a group, being in simultaneous contact, and doing things jointly by combined action. A system can promote both immediate and delayed togetherness, as seen in the quiz game. At work, togetherness may be important as it is at home, but at home it is in focus (as also concluded by Hindus et al., 2001). Spending time with ones family is what counts as quality time, but at work, spending time with the work-mates is not considered as quality time even though it might be important in order to build share understanding and hence facilitate co-ordination processes. Get-togethers at work as well as parties and kick-offs are, however, important parts of team building. Designing information systems for such activities at work would without doubt be a challenge.

Face management is at play in every joint activity. Actually, in the case of the quiz game, much of the fun comes from playing around

with face issues. At the bank the face management is about professional identity, professional trust, and freedom of action. Systems at the bank were seen to either facilitate face management or interfere with it. At home it is about private social identification and differentiation (Hindus, et al., 2001), but also about parental control (O'Brien, et al., 2000). At the same time kids wish to create space for action: negative face. Face work and negotiation between grown ups and kids in relation to information appliances would be interesting to study. The different facets of face management, as a use quality, will be vital in all co-present groupware, and probably important for any system that is used in a shared activity. This includes all SDGs and probably all iTV-applications. Design for face work is indeed an intriguing concept, both for IT at home and IT at work. An interesting theoretical issue of togetherness is the relation between delayed togetherness, socio-cultural situatedness and positive face. On the theoretical basis of these three concepts it should be possible to design lifestyle products. What is good positive face in the eyes of someone is of course dependent on subjective factors, but also on the socio-cultural history of the individual, and the present situation. Krippendorff (1995) proposes product semantics as theoretical foundation for such issues.

Aesthetic use

The use of iTV-appliances should not only be effortless, but also be experienced as being effortless. At he bank the feeling of control is just as important for individual advisors, as actual accuracy is.

The word 'seduction' was used to describe the entertaining experience of iTV-appliances. It comes from Latin, originally meaning an act of leading aside. When something is seducing it attracts, charms, and perhaps even enchants a user. It is a use quality that arises when the present activity is all there is and an emotional bond may be tied between the users and the system. The surface level of a seductive experience is clearly dependent on the ante-use of the system; what the users expect to meet will decide if they are enticed by the product, or if it is yet another product of the same kind as before. It will also decide if the user is willing to enter a state of flow or only dismiss the attempt to seduction as foolishness. Woszczynski et al. (2002) reports that flow experiences can have positive as well as negative effects. The positive

effects include user satisfaction, increased learning, creativity, and intrinsic motivation. The negative effects are decreased efficiency, over-involvement, or even addiction. Seduction is without doubt more important for consumer products than it is for office systems, but in order for a system to sell and get satisfied users, it might be important to consider. A seductive software has ecstatic customers that loves the product and place stickers on their cars that says: "I love my [insert product name here]!" That is definitely something to strive for as an interaction designer.

Entertainment is part of the seductive experience of playing a game or watching a race, but hardly important at all in a banking context, where it will be counterproductive and perhaps even damaging to the bank. The only time it is called for is in an e-learning system used during competence development at the bank. Two aspects of entertainment are, however, ego challenge and social challenge. Ego challenge is the testing of skills and knowledge, and encourages psycho-pleasure. This is something that often arises in situations at work and at such times users may even enter at state of flow. Social challenge is a safe conflict. It can be a matter of comparing strengths, also a matter of managing complex social interaction. Both of these aspects of entertainment are potentially useful in e-learning systems.

Any system must have an aesthetic expression that fits its context. iTV-appliances are situated among systems like text-TV, VCRs, stereos, and so on. They are also related to web pages and television on-screen display graphics and without bearing any resemblance to such systems it will not build fitting expectations among users and it will not fit in. The same goes for systems at banks: they must feel professional, accurate, exact, and carry a sober expression.

Moral considerations

Should software designers make systems that increase the profit for the bank at the expense of customers or should the designers view the customers' interests as equally important as the banks'. The analysis of the systems used during customer meetings were mainly made from the advisors' point of view. It is questionable if that is the right way to proceed in the long run. The customer must be considered as important as the advisor is. Another moral issue to consider is the bank secrecy, and personal integrity of customers.

In the home one must consider how large the parental control should be, and if a particular software reinforces gender stereotypes, everyday patriarchal structures, and traditional views on the role of women. Just as at the bank, issues of integrity and the relation between personal and public information is vital to take into account.

Material considerations

The issue of platforms is interesting both in the home and at the bank. Bank tends to use traditional PCs with mouse and keyboard, even though other systems could be considered. This is probably due to a negative set among system designers that simply design what they are used to be designing. However, in order to design a good common research for advisors and customers touch screens lying between the users might be better, in combination with personal screens for information that the advisor want to keep for him- or herself (e.g the profitability of the customer and warnings that the system gives regarding loans). Some parts of the systems can be fairly controlled and guided, where for example legislation or efficiency demands so. In order to increase the flexibility in the social interaction it can rather be fairly open, more like a sheet of paper.

In the home, similar platforms can be considered where users have personal Tablet PCs for pursuing personal goals, while still having the possibility of sharing information on shared displays like the TV-screen. Such systems are today too expensive on the consumer market, but who knows what the future has the possibility to bring.

Systems that utilize multiple screens have the potential to make the shifts in styles of use and interaction characters with minimal effort. That would increase the flexibility of the systems in relation to coordination of personal and joint goals in co-located joint activities. One can also imagine systems that utilize personalisation and co-adopts to users in the midst of interaction. Such partner technology could perhaps change character in order to fit the present style of interaction.

Generalisation of results

Different genres of iTV-appliances will lead to somewhat different use qualities to design for. It is not straightforward to generalise from the quiz game to any situation where iTV is used. Some analytical generalisation is however possible, since a collective case study was made,

where the quiz game can be compared to the racing add-on and the on-demand news application. More issues of laidback interaction are apparent in the racing add-on than it is in the quiz game, and more issues of togetherness surfaces in the quiz game than in the racing add-on, and in the on-demand news a trade-off between the two became apparent. Entertainment is equally important in all three, but it is reached by different means. In much infotainment, such as the add-on to the Formula 1 racing and the on-demand news, the content is what matters. That is where the value of using the system is to access seductive content in an entertaining fashion, and that is more important than togetherness is. Still talking about the content is also valuable.

In the quiz game laidback interaction is also important, but the purpose of it is to enhance togetherness, so that the interaction with the game application can become semi-transparent and set the social interaction focus instead. The entertaining experience of the quiz game comes mainly from the activity of playing with a friend.

For any infotainment software to be used on iTV, the use qualities presented here will be important, but the priority between them will differ, as will the means for reaching the use quality objectives in a design solution. The research question for this thesis is, however: "What use qualities can be used to set objectives in design of software for co-present use at home, in contrast to use qualities for such systems at work?" I do not want to generelise the results from the couch in the living room to the entire home. The case of iTV is nevertheless an illustration of one kind of software that exists within the walls of the home.

The bank case provides examples of other use qualities to design for than the traditional usability criteria in the genre of office software. That indicates that one must always question the taken-for-granted model of what good interaction design is in a specific situation of use and take a step back in order to re-evaluate use quality criteria.

6.2   Future research

People are in reality in quite messy situations, where they at one time may work individually and at the next time may work jointly with others. For example, clerks at banks and in other service establishments use systems as support in their meetings with customers and sometimes they turn their screens towards the customer in order to present

something or explain something (see Chapter 4 in this thesis). Furthermore, students often share computers as well as work on personal projects and need to co-ordinate these two (Geisler, Rogers & Tobin, 1999). In addition, people in control rooms can work individually during normal situations, but in order to regain control when something goes wrong they must coordinate their actions and get a shared understanding of the situation. Then artifacts, previously in individual use, will be jointly used in order to establish common ground (Garbis 2002). Finally, a designer that is stuck in the creative work usually turns to a colleague for help to see the problem from a new angle (Sachs, 1999), and then the system turns from being in individual use into being in joint use. There is a long tradition of research, within HCI, on how to design computer systems for individual use, and there is also huge amount of work within the field of computer supported cooperative work, on how to design computer support for teams. There is, however, only little research (Geisler, Rogers & Tobin, 1999; and Rodden Rogers, Halloran & Taylor, forthcoming) that have focused on systems that are both individually and jointly used.

Software usage in face-to-face situations

There are several approaches to how to design software for use in face-to-face situations. There are electronic meeting room systems that assist co-located collaboration. Examples include different kinds of electronic whiteboards (Elrod, Bruce, Gold, Goldberg, Halasz, Janssen, Lee, McCall, Pedersen, Pier, Tang & Welch, 1992) and large shared displays (Dourish & Bellotti, 1992; Garbis, 2002), entire meeting rooms (Stefik, Foster, Bobrow, Kahn, Lanning & Suchman, 1987; Nunamaker, Dennis, Valacich, Vogel, & George, 1991; Geisler, Rogers & Tobin, 1999). There are also Single Display Groupwares (SDGs), which enable shoulder-to-shoulder collaboration by means of simultaneous parallel input to a single shared display for output (Stewart, Bederson & Druin, 1999; Benford et al., 2000). Finally, there is research into Single Display Privacyware (SDP), which is a direct extension of SDG. Such software allow co-located people to work privately on a individual screen, such as a PDA, and also allow them to share information on a publicly available screen, and choose what to do on the big shared screen and what to do on the small private screen (Schoemaker & Inkpen, 2001). Interfaces for SDPs and other software that are distributed over several devices have been called distributed interfaces (see Figure 6.2) within the field of ubiquitous computing. One such distributed

interface is SharedNotes, which is designed by Greenberg, Boyle and LaBerge (1999). They enforced a strict difference between public and private, where notes could be either completely private for individual use or completely public for joint use but nothing in between. It did not work very well and instead they recommend a design that allows users to fluidly shift between the two and the many gradations in between.
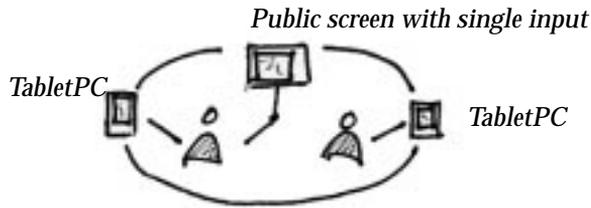

Figure 6.2: A distributed interface where information can be thrown between screens. Users can switch interaction characters at their will depending on present individual or joint goals.

Research problem

There are times when we really do not want somebody to see our work. At other times we need to work together in order to reach our goals. Therefore the use of computer systems will shift between individual and joint use. A distributed interface that allows users to choose what information to share with whom they want, in any way they choose, is likely to support both individual and joint activities, including swift shifts between the two. The main focus of the future research is to explore what constitutes good shifts between individual and joint use of technology, from the perspectives of the users. In particular, the research will report design considerations that emerge from shifts between individual and joint use of computer technology in a software design team, that work in the early phases of software development. Design implications for distributed interfaces will be explored, and the results will be related to the research presented in this thesis; the use of software in customer meetings at banks, and the use of iTV-appliances.

Method

In order to explore the research problem a field study in a software design team will be conducted. Specific focus will lie on events where user activities change from being individual to being joint and back again (see Figure 6.3). The method of choice is participatory observation and ethnographic interviews. Interactions will also be captured on video. Design sessions will follow on these observations, where existing computer technology will be further developed by taking identified issues into account, and by exploring the design concept of distributed interfaces.
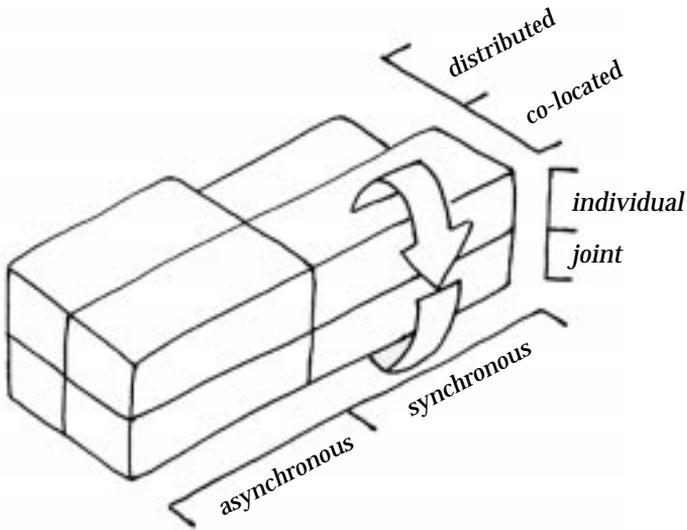

Figure 6.3: The focus of future research is on co-located and synchronous situations of use, where technology switch between being in private/individual use and in public/joint use.

Expected contributions

The research will further develop the knowledge of how to design computer technology that both are in individual use and in joint use. Such situations include design work, customer meetings, home usage of IT, command & control work, education, process control et cetera.

Specifically it will look into software design work and compare situations of use there with situations of use in customer meetings at banks and joint use of iTV-appliances. It will explore the novel concept of distributed interfaces in this context, and it will expand the knowledge about the early phases of software design practices.

6.3 Conclusions

The conclusions from this thesis can be grouped under three headings: contrasts between home and work, software use quality in general, and future work about co-present use of software.

Interaction design for the home

The research question for this thesis was: "What use qualities can be used to set objectives in design of software for co-present use at home, in contrast to use qualities for such systems at work?" It has been explored by comparing the designof a system used at bank offices to the design of iTV-appliances. Several differences, but also similarities were experienced and identified in the analysis, and some conclusions can be drawn:

1. The fundamental aspects of the traditional usability is central in both settings, but for different purposes. The home setting is less goal-oriented than the work setting, and therefore the activities are highly opportunistic. The home is also a place for rest and escape from the pressures of work, and consequently the use situations are often characterised by a laidback interaction.

2. At work, *togetherness* may be important as it is at home, but at home it is in focus. The greatest concern of home life is the family, but also other members of the extended family and friends are important to spend quality time with.

3. *Face work* is also at play in both settings, but again the purpose and object of the face management is different. The home reflects the positive face that the people in the household want to give. There is also face work going on between family members, especially between teens and grown-ups.

4. *Entertainment* is definitely more important to design for in infotainment products and other consumer products or services, than it is in office software, but it may still be valuable in a work setting

where many flow experiences actually take place, even though entertainment is not an end in itself.

5. Good *ante-use* is highly valued in a bank setting where good planning and fair expectations set the ground for the use quality of the software. In the home ante-use is a more difficult concept, due to the opportunistic activities, but still, it is imperative to design good expectations and to have everything laid out so that no preparations and planning need to be done.

To conclude: The usability community needs to revise its understanding of the concept of usability (a process that has been well under way for ten years now) in order to cope with the laidback and opportunistic activities that take place in a home. It also needs to incorporate issues of how family and friends spend time together. Laidback interaction, togetherness, and entertainment are the use qualities to design for in iTV infotainment appliances. These qualities are interconnected and to some extent dependent on each other and the priority of them may vary between different infotainment systems.

Software use quality

Turning from the specific conclusions tightly connected to the cases and the research question, some conclusions on a more general level can be drawn.

The narrow version of usability and quality in use (e.g. ISO 9241-11, 1998; and Bevan, 1999, 2001) is not sufficient to cover what I mean by the term 'use quality:' what that makes a software good to use. It was developed for office software, but the case study from bank offices has indicated that other qualities than effectiveness, efficiency and satisfaction may be important to design for in that genre of software.

It is evident in the results of the case studies that every use quality carries aspects of all three kinds of use; they are only aspects of a whole, even though their focus is on one of the three. Laid-back interaction has for example its focus in practical use, but it has social aspects within it, as well as aesthetic aspects since it also includes the feeling of being laid-back.

When working with use quality in an interaction design process the designers can enter the future situation of use and complete the sentence: "The use of the system should be characterised by…" The

designers then try to cover practical use, social use and aesthetic use as well as ethics and construction. When a list of desirable use qualities is established it can be ordered and prioritized as use quality objectives. This list is used to assess design alternatives in the midst of the nitty-gritty design work by means of +/- lists. This ensures a documentation of the design rationale without disturbing the flow of sketching.

Into the future

The planned research will focus on design of software in face-to-face situations of use that often occur in both home settings and work settings. It will contribute with knowledge of how to design computer technology that both are in individual use and in joint use in such situations. In particular it will investigate software design work and compare face-to-face situations of use there with situations of use in customer meetings at banks and joint use of iTV-appliances. It will elaborate the novel concept of distributed interfaces in this setting, and it will expand the knowledge about the conceptual phases of software design practices.

REFERENCES

Agre, P. E. (1998). Designing genres for new media: Social, economic and political contexts. In S. G. Jones (Ed.), *CyberSociety 2.0: revisiting computer-mediated communication and community.* London: SAGE Publications.

Ampler, F. (1998). *Designing navigation for interactive television.* Master's thesis LiU-KOGVET-D-0005-SE, Linköpings universitet, Sweden.

Arvola, M. (1999). *A battle of wits – Shared feedback in multi-user applications with single-user control.* Master's thesis LiU-KOGVET-D-0015-SE, Linköpings universitet, Sweden.

Arvola, M., & Holmlid, S. (2000). IT-artefacts for socializing: Qualities-in-use and research framework. In L. Svensson, U. Snis, O. Sørensen, H. Fagerlind, T. Lindroth, M. Magnusson, and O. Östlund (Eds.), *Proceedings of IRIS 23.* Laboratorium for Interaction Technology, University of Trollhättan Uddevalla. http://iris23.httu.se/proceedings/PDF/78final.PDF . 2001-05-28.

Becker, H. S., & Geer, B. (1957). Participant Observation and Interviewing: A Comparison. *Human Organization, 16 (Fall, 1957),* pp. 28–32.

Benford, S., Bederson, B B., Åkesson, K-P., Bayon, V., Druin, A., Hansson, P., Hourcade, J. P., Ingram, R., Neale, H., O'Malley, C., Simsarian, K. T., Stanton, D., Sundblad, Y., & Taxén, G. (2000). Designing storytelling technologies to encourage collaboration

between young children. *Proceedings of the CHI 2000 conference on Human factors in computing systems*, 556–563, April 1–6, 2000, The Hague, Amsterdam.

Bevan, N. (1995). Measuring usability as quality of use. *Journal of Software Quality Issue 4*, pp. 115–140.

Bevan, N. (1999). Design for usability. In H-J. Bullinger and J. Ziegler (Eds.), *Human-computer interaction: proceedings of HCI International '99 (the 8th International Conference on Human-Computer Interaction)*, Munich, Germany, August 22–26, 1999.

Bevan, N. (2001). Quality in use for all. In C. Stephanidis (Ed.), *User interfaces for all: Concepts, methods, and tools.* Mahwah, NJ: Lawrence Erlbaum Associates.

Beyer, H., & Holtzblatt, K. (1997). *Contextual design: Defining customer-centered systems.* San Francisco, CA: Morgan Kaufmann Publishers.

Boland, R. J., Jr. (1985). Phenomenology: A preferred approach to research on information systems. In E. Mumford et al. (Eds.), *Research Methods in Information Systems.* Amsterdam: North-Holland.

Bratteteig, T., & Stolterman, E. (1997). Design in groups and all that jazz. In M. Kyng and L Mathiassen (Eds.), *Computers and Design in Context.* Cambridge, MA: MIT Press.

Brook, J. B. (1986). Usability engineering in office automation. In M. D. Harrison and A. F. Monk (Eds.), *People and computers: Designing for usability.* Cambridge, UK: Cambridge University Press.

Brown, P., & Levinson, S. (1987). *Politeness: some universals in language use.* Cambridge, UK: Cambridge University Press.

Burke, K. (1969). *A grammar of motives.* Berkeley, CA: University of California Press.

Carroll, J.M. (2000). *Making use: Scenario-based design of human-computer interactions.* Cambridge, MA: MIT Press

Carroll, J.M. & Rosson, M.B. (1992). Getting around the task-artifact cycle: How to make claims and design by scenario. *ACM Transactions on Information Systems, 10,* 181–212.

Clark, H. H. (1996). *Using language.* Cambridge, UK: Cambridge University Press.

Cole, M., & Engeström, Y. (1993).A cultural-historical approach to distributed cognition. In G. Salomon (Ed.), *Distributed cognitions—Psychological and educational considerations.* Cambridge, UK: Cambridge University Press.

Crawford, C. (1982). *The Art of Computer Game Design.* (Electronic version from 1997). Washington State University. REV.10.23.00. http://www.vancouver.wsu.edu/fac/peabody/game-book/ Coverpage.html . 2001-05-28.

Cross, N. (2000). *Engineering Design methods: Strategies for Product Design—3rd ed.* Chichester: John Wiley & Sons Ltd.

Csikszentmihalyi, M., & LeFevre, J. (1989). Optimal experience in work and leisure. *Journal of Personality and Social Psychology, 56 (5),* 815–822.

Davis, J. C. (1985). A typology of management information systems users and its implication for user information satisfaction research. *Proceedings of the twenty-first annual conference on Computer personnel research,* 152–164.

D'Andrade, R. (1995). *The development of cognitive anthropology.* Cambridge, UK: Cambridge University Press.

Dahlbom, B., & Mathiassen, L. (1995). *Computers in context: the philosophy and practice of systems design.* Oxford: Blackwell.

Dourish, P., & Bellotti, V. (1992). Awareness and coordination in shared workspaces. *CSCW 92 Proceedings,* 107–114.

Ehn, P. (1988). *Work-oriented design of computer artifacts.* Stockholm: Arbetslivscentrum.

Ehn, P., & Löwgren, J. (1997). Design for quality-in-use: Human-computer interaction meets informations systems development. In M. Helander, T. Landauer, and P. Prabhu (Eds.), *Handbook of human-computer interaction. Second, completely revised edition.* Amsterdam: Elsevier.

Ehn, P., Meggerle, T., Steen, O., & Svedemar, M. (1997). What kind of a car is this sales support system? On styles, artifacts, and quality-in-use. In M. Kyng and L. Mathiassen (Eds.), *Computers and design in context.* Cambridge, MA: MIT Press.

Elrod, S., Bruce, R., Gold, R., Goldberg, D., Halasz, F., Janssen, W., Lee, D., McCall, K., Pedersen, E., Pier, K., Tang, J., & Welch, B. (1992). Liveboard: a large interactive display supporting group meet-

ings, presentations, and remote collaboration. *Proceedings of the CHI '92 conference on Human factors in computing systems: striking a balance,* 599–607, May 3–7, 1992, Monterey, CA, USA.

Ely, M. (1991). *Doing Qualitative Research: Circles in Circles.* New York, NY: The Flamer Press.

Faulkner, X. (2000). *Usability engineering.* London: Macmillan Press.

Firestone, W. A. (1993). Alternative arguments for generalizing from data as applied to qualitative research. *Educational Researcher, May 1993,* 16–23.

Forsythe, D. E. (1999). "It's just a matter of common sense": Ethnography as invisible work. *Computer Supported Cooperative Work, 8 (1-2),* 127–145.

Friedman, B. (1996). Value-sensitive design. *interactions, 3 (6)*, 17–23.

Friedman, B. (Ed.) (1997). *Human values and the design of computer technology.* Stanford, Ca., and Cambridge, UK: CSLI Publications and Cambridge University Press.

Frohlich, D. M., Dray, S., & Silverman, A. (2001). Breaking up is hard to do: family perspectives on the future of the home PC. *International Journal of Human-Computer studies, (2001) 54,* 701–724.

Gahlin, A. (1989). Tittarsituationen – om sällskap, bredvidsysslor och uppmärksamhet framför tv:n. *Publik och programforskning, 16.* Stockholm: Sveriges Radio. In Swedish.

Garbis, C. (2002). *The Cognitive Use of Artifacts in Cooperative Process Management: Rescue Coordination and Underground Line Control.* Dissertation, Linköping, Sweden:. Linköpings universitet.

Garfinkel, H. (1967). *Studies in Ethnomethodology.* Englewood Cliffs, NJ: Prentice-Hall.

Gaver, W., & Dunne, A. (1999). Projected realities: Conceptual design for cultural effect. *Proceedings of the CHI '99 conference on Human factors in computing systems: the CHI is the limit*, 600–607, May 15–20, 1999, Pittsburgh, PA, USA.

Gaver, B., Dunne, T., & Pacenti, E. (1999). Cultural probes. *interactions, 6 (1),* 21–29.

Gaver, B., & Martin, H. (2000). Alternatives: Exploring information appliances through conceptual design proposals. *Proceedings of the CHI 2000 conference on Human factors in computing systems*, 209–216, April 1–6, 2000, The Hague, Amsterdam.

Geertz, C. (1973). *The Interpretation of Cultures: Selected Essays.* New York, NY: Basic Books.

Geisler, C., Edwin, H. R., & Tobin, J. (1999). Going public: Collaborative systems design for multidisciplinary conversations. *Proceedings of Cooperative Buildings: Integrating Information, Organizations and Architecture: Second International Workshop, CoBuild'99*, October 1-2, 1999, Pittsburgh, USA.

Goffman, E. (1967). *Interaction ritual: Essays in face-to-face behavior.* Chicago, IL: Aldine.

Goodwin, C. (1994). Professional vision. *American Anthropologist 96 (3),* 606–633.

Greenbaum, J., & Kyng, M. (1991). *Design at work: Cooperative design of computer systems.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Greenberg, S., Boyle, M., LaBerge, J. (1999). PDAs and shared public displays: Making personal information public, and public information personal. *Personal Technologies, 3 (1),* 54–64

Haber, R.N., & Hershenson, M. (1973). *The psychology of visual perception.* New York, NY: Holt, Rinehart and Winston.

Harris, M. (1994). Entertainment driven collaboration. *Computer Graphics, 28 (2),* 93–96.

Hindus, D., Mainwaring, S. D., Leduc, N., Hagström, A. E., & Bayley, O. (2001). Casablanca: Designing social communication devices for the home. *Proceedings of the CHI 2001 conference on Human factors in computing systems*, 325–332, March 31–April 4, 2001, Seattle, WA., USA.

Hooper, K. (1986). Architectural design: An analogy. In D. A. Norman and S. W. Draper (eds.), *User centered systems design: New perspectives on human-computer interaction.* Hillsadale, NJ: Lawrence Erlbaum Associates.

Hollnagel, E. & Woods, D. D. (1983). Cognitive systems engineering: New wine in new bottles. *International Journal of Man-Machine Studies, 18,* 583–600.

Holmlid, S. (1997). User perceptions of effects of training: In search for qualities in use. *Linköping electronic articles in computer and information science, Vol. 2(1997): nr 8.* http://www.ep.liu.se/ea/cis/1997/008 . 1997-08-29.

Holmlid, S. (1998). Futurism and retrospect: User strategies to learning opportunities in cases of surprise or confusion. *Human IT, 2 (3),* 115–130, Högskolan i Borås, Sweden.

Holmlid, S. (2002). *Adapting users: Towards a theory of use quality.* Disseration. Linköping, Sweden: Linköpings universitet.

Holmlid, S., Arvola, M., & Ampler, F. (2000). Genres and Design Considerations of iTV Cases. In J. Gulliksen, A. Lantz, L. Oestreicher and K. Severinson Eklundh (eds.), *Proceedings of NordiCHI 2000 "Design vs. design"*, October 23–25, 2000, Royal Institute of Technology, Stockholm.

Holmquist, L. E. (1997). The right kind of challenge. *IRIS 20 Electronic Proceedings.* http://iris.informatik.gu.se/conference/iris20 . 2001-05-28.

Holtzblatt, K., & Beyer, H. (1993). Customer-centered design work for teams. *Communications of the ACM, 36 (10),* 92–103.

Hutchins, E. (1995). *Cognition in the wild.* Cambridge, MA: MIT Press.

Howard, M. V. (1999). Visualising automation behaviour. In S. Dekker an E. Hollnagel (Eds.), *Coping with Computers in the Cockpit.* Aldershot, UK: Ashgate.

Howard, M. V. (2002a). *Usefulness in Representation Design.* Linköping studies in science and technology, Dissertation no. 753. Linköping, Sweden: Linköpings universitet.

Howard, M. V. (2002b). *Supporting design for quality-in-use through abstract usability objectives.* (in press)

Hård av Segerstad, U. (1957). *Tingen och vi.* Stockholm: Nord. rotogravyr: [Seelig]. In Swedish only.

Ihde, D. (1979). *Technics and praxis: A philosophy of technology.* Dordrecht: Reidel.

Ihlström, C., & Lundberg, L. (2002). The audience of Swedish local online newspapers: a longitudinal study. ELPUB 2002. Karlovy Vary, Czech Republic. November 2002.

ISO 9241-11 (1998). *Ergonomic requirements for office work with visual display terminals (VDTs)—Part 11. Guidance on usability.* Geneva, Switzerland: International Standards Organisation.

ISO/IEC 14598-1. (1998). *Information technology—Evaluation of software products—Part 1. General guide.* Geneva, Switzerland: International Standards Organisation.

ISO/IEC FDIS 9126-1. (2000). *Software product quality—Part 1: Quality model.* Geneva, Switzerland: International Standards Organisation.

Janlert, L-E., & Stolterman, E. (1997). The character of things. *Design Studies, 18 (1997)*, 297–314.

Jordan, P. W. (1998). Human factors for pleasure seekers. *Ergonomia No.11,* 14–19.

Jones, J. C. (1992). Design methods, 2., rev. ed. New York, NY.: Van Nostrand Reinhold: New York, NY: Wiley

Junestrand, S., Keijer, U., & Tollmar, K. (2001). Design patterns for private and public digital spaces in the home environment. *International Journal of Human-Computer Studies, 54,* 753-778.

Kammersgaard, J. (1988). Four different perspectives on human-computer interaction. *International Journal of Man-Machine Studies (1988) 28*, 343–362.

Khaslavsky, J., & Shedroff, N. (1999). Understanding the seductive experience. *Communications of the ACM, 42 (5),* 45–49.

Klein, H. K., & Myers, M. D. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly, 23 (1),* 67–93.

Krippendorff (1995). On the essential contexts of artifacts or the proposition that "design is making sense (of things)". In V. Margolin and R. Buchanan (Eds.), *The Idea of Design.* Cambridge, MA: The MIT Press.

Kuutti, K. (1996). Activity theory as a potential framework for human-computer interaction research. In B. Nardi (Ed.), *Context and consciousness—activity theory and human-computer interaction.* Cambridge, MA: MIT Press.

Lacohée, H., & Anderson, B. (2001). Interacting with the telephone. *International Journal of Human-Computer Studies, 54,* 665–699.

Lambert, S. (1993). *Form follows function? Design in the 20th century.* Victoria & Albert Museum.

Laseau, P. (1989). *Graphic thinking for architects and designers, second edition.* New York, NY: John Wiley & Sons, Inc.

Laurel, B. (1993). *The computer as theatre.* Reading, MA: Addison-Wesley.

Lundberg, J. (2001). On-line newspapers and genre development on the world wide web. In, *Proceedings of IRIS 24.* Department of Information Science, University of Bergen.

Löwgren, J. (1993). *Human-computer interaction: What every systems developer should know.* Lund: Studentlitteratur.

Löwgren, J., & Stolterman, E. (1998*). Design av informationsteknik – materialet utan egenskaper.* Lund: Studentlitteratur. In Swedish only.

MacLean, A., Young, R. M., & Moran, T. P. (1989). Design rationale: The argument behind the artifact. *Proceedings of the CHI '89 conference on Human factors in computing systems,* 247–252, May 1989, Austin, USA.

McCullough, M. (1998). *Abstracting craft: The practiced digital hand.* Cambridge, MA: MIT Press.

McQuail, D (1994). *Mass communication theory. An Introduction, Third edition.* London: SAGE Publications.

Mogensen, P. (1992). Towards a provotyping approach in systems development. *Scandinavian Journal of Information Systems, vol. 4 (1992).*

Moggridge, B. (1999). Expressing experiences in design. *interactions, 6 (4),* 17–25.

Neisser, U. (1976). Cognition and reality: Principles and implications of cognitive psychology. San Francisco, CA: Freeman.

Nunamaker, J. F., Dennis, A. R, Valacich, J. S., Vogel, D. R., & George, J. F. (1991). Electronic meeting rooms to support group work. *Communications of the ACM, 34 (7),* pp. 40–61.

O'Brien, J., Rodden, T., Rouncefield, M., & Hughes, J. (2000). At home with the technology: An ethnographic study of a set-top-box trial. *ACM Transactions of Computer-human interaction, 6 (3),* 282–308.

Palen, L. (1999). Social, individual and technological issues for groupware calendar systems. *Proceedings of the CHI '99 conference on Human factors in computing systems: the CHI is the limit,* 17–24, May 15–20, 1999, Pittsburgh, PA, USA.

Paulsson, G., & Paulsson, N. (1957). *Tingens bruk och prägel.* Stockholm: Kooperativa förbundets bokförlag. In Swedish only.

Polanyi, M. (1967). *The Tacit Dimension.* New York, NY: Doubleday.

Redström, J. (2001). *Designing Everyday Computational Things.* Dissertation, Göteborg University.

Rimbark, M. (2002). *Do's and Dont's in Applications for Co-surfing News.* Master's thesis LiU-KOGVET-D--02/02--SE, Linköpings universitet, Sweden. http://www.ep.liu.se/exjobb/ida/2002/002/. 2002-06-13.

Rodden, T., Rogers, Y., Halloran, J., & Taylor, I. (forthcoming). Designing novel interactional workspaces to support face to face consultations. Submitted to CHI '03.

Rowe, P. G. (1987). *Design thinking.* Cambridge, MA: The MIT Press.

Sachs, A. (1999). "Stuckness" in the design studio, *Design Studies 20 (2)*, pp. 195–209.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action.* UK: Basic Books.

Schön, D. A. (1992). Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems, 5(1)*, 3–14.

Schuler, D., & Nemioka, A. (1993). *Participatory design: Principles and practices.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Schum, S. (1991). Cognitive dimensions of design rationale. In D. Diaper and N. V. Hammond (Eds.), *People and Computers VI.* Cambridge, UK: Cambridge University Press.

Scott, S.D., Mandryk, R.L, & Inkpen, K.M. (2002). Understanding Children's Interactions in Synchronous Shared Environments. Proceedings of Computer Supported Collaborative Learning (CSCL) 2002. Boulder, CO, USA. January 2002.

Scott, S.D., Shoemaker, G.B.D., & Inkpen, K.M. (2000). Towards seamless support of natural collaborative interactions. Proceedings of Graphics Interface. Montreal, Canada. May 2000.

Shackel, B. (1986). Ergonomics in design for usability. In M. D. Harrison and A. F. Monk (Eds.), *People and computers: Designing for usability.* Cambridge, UK: Cambridge University Press.

Sherman Heyl, B. (2001). Ethnographic interviewing. In P. Atkinson, A. Coffey, S. Delamont, J. Lofland and L. Lofland (Eds.), *Handbook of Ethnography.* London: SAGE Publications.

Shoemaker, G. B. D., & Inkpen, K. M. (2001). Single display privacy-ware: Augmenting public displays with private information. *Proceedings of the CHI 2001 conference on Human factors in computing systems,* 552–529, March 31–April 4, 2001, Seattle, WA, USA.

Stake, R. E. (1994). Case studies. In N. Denzin, and Y. Lincoln (Eds.), *Handbook of Qualitative Research.* London: SAGE Publications.

Stefik, M., Foster, G., Bobrow, D. G., Kahn, K., Lanning, S., & Suchman, L. (1987). Beyond the chalkboard: Computer support for collaboration and problem solving in meetings. *Communications of the ACM, 30 (1),* pp. 32–47.

Stewart, J., Bederson, B. B., & Druin, A. (1999). Single display groupware: A model for co-present collaboration. *Proceedings of the CHI 99 conference on Human factors in computing systems: the CHI is the limit,* 286–293, May 15–20, 1999, Pittsburgh, PA, USA.

Stewart, J., Raybourn, E. M., Bederson B., & Druin, A. (1998). When two hands are better than one: Enhancing collaboration using single display groupware. *Proceedings of the conference on CHI 98 summary: human factors in computing systems,* 287–288, April 18–23, 1998, Los Angeles, CA, USA.

Stolterman, E. (1991). *Designarbetets dolda rationalitet – en studie av metodik och praktik inom systemutveckling.* RRIPCS; Nr 14.91. Department of Informatics, Umeå University, Umeå, Sweden.

Stolterman, E., & Nelson, H. (2000). The guarantor of design: g.o.d. In L. Svensson, U. Snis, O. Sørensen, H. Fagerlind, T. Lindroth, M. Magnusson, and O. Östlund (Eds.), *Proceedings of IRIS 23.* Laboratorium for Interaction Technology, University of Trollhättan Uddevalla. http://iris23.htu.se/proceedings/PDF/28final.PDF . 2001-06-06.

Strauss, A., & Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques.* London: SAGE Publications.

Tiger, L. (1992). *The Pursuit of Pleasure.* Boston, MA: Little, Brown and Company.

Tolmie, P., Pycock, J., Diggins, T., MacLean, A., & Karsenty, A. (2002). Unremarkable computing. In *Proceedings of the conference on CHI 2002: human factors in computing systems,* 399–406, April 20–25, 2002, Minneapolis, Minnesota, USA.

Tyldesley, D.A. (1988). Employing usability engineering in the development of office products. *Computer Journal, 31 (5)*, 431–436.

Venkatesh, A. (1996). Computers and other interactive technologies for the home. *Communications of the ACM 39, (12)*, 47–54.

Vickers, D. (1979). *Decision processes in visual perception.* New York, NY: Academic Press.

Wertsch, J. V. (1998). *Mind as action.* New York, NY: Oxford University Press.

Wiberg, M. (2001a). *In between mobile meetings: Exploring seamless ongoing interaction support for mobile CSCW.* Dissertation, Department of Informatics, Umeå University, Umeå Sweden.

Wiberg, M. (2001b). RoamWare: An integrated architecture for seamless interaction in between mobile meetings. In *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work - Volume 2001,* 288–297, September 30–October 3, 2001, Boulder, Colorado, USA

Winograd, T. (1996). *Bringing design to software.* New York, NY.: ACM: Reading, MA. Harlow: Addison-Wesley

Winograd, T. (2001). From programming environments to environments for designing. In C. Stephanidis (Ed.), *User interfaces for all: Concepts, methods, and tools.* Mahwah, NJ: Lawrence Erlbaum Associates.

Woszczynski, A. B, Roth, P. L., & Segars, A. H. (2002). Exploring the theoretical foundations of microcomputer playfulness. *Computers in Human Behavior, 18 (4),* 369–388.

Woods, D. D., & Roth, E. M. (1988). Cognitive systems engineering. In M. Helander (Ed.), *Handbook of human-computer interaction.* New York, NY: North-Holland.

Zanella, A., & Greenberg, S. (2001). Reducing interference in single display groupware through transparency. Proceedings of The Sixth European Conference on Computer Supported Cooperative Work (ECSCW 2001), Bonn, Germany. September 2001.

Titel
Title

Good to use! : Use quality of multi-user applications in the home

Författare
Author

Mattias Arvola

Sammandrag
Abstract

Traditional models of usability are not sufficient for software in the home, since they are built with office software in mind. Previous research suggest that social issues among other things, separate software in homes from software in offices. In order to explore that further, the use qualities to design for, in software for use in face-to-face meetings at home were contrasted to such systems at offices. They were studied using a pluralistic model of _use quality_ with roots in socio-cultural theory, cognitive systems engineering, and architecture. The research approach was interpretative design cases. Observations, situated interviews, and workshops were conducted at a Swedish bank, and three interactive television appliances were designed and studied in simulated home environments. It is concluded that the use qualities to design for in infotainment services on interactive television are _laidback interaction_, _togetherness_ among users, and _entertainment_. This is quite different from bank office software that usually is characterised by not only traditional usability criteria such as learnability, flexibility, effectiveness, efficiency, and satisfaction, but also professional _face management_ and _ante-use_. Ante-use is the events and activities that precedes the actual use that will set the ground for whether the software will have quality in use or not. Furthermore, practices for how to work with _use quality values_, _use quality objectives_, and _use quality criteria_ in the interaction design process are suggested. Finally, future research in design of software for several co-present users is proposed.

Nyckelord
Keywords

interactive television (iTV), interaction design, usability, use quality, collaboration, bank software, customer meetings, face-to-face situations of use, home informatics

No 17   **Vojin Plavsic:** Interleaved Processing of Non-Numerical Data Stored on a Cyclic Memory. (Available at: FOA, Box 1165, S-581 11 Linköping, Sweden. FOA Report B30062E)

No 28   **Arne Jönsson, Mikael Patel:** An Interactive Flowcharting Technique for Communicating and Realizing Algorithms, 1984.

No 29   **Johnny Eckerland:** Retargeting of an Incremental Code Generator, 1984.

No 48   **Henrik Nordin:** On the Use of Typical Cases for Knowledge-Based Consultation and Teaching, 1985.

No 52   **Zebo Peng:** Steps Towards the Formalization of Designing VLSI Systems, 1985.

No 60   **Johan Fagerström:** Simulation and Evaluation of Architecture based on Asynchronous Processes, 1985.

No 71   **Jalal Maleki:** ICONStraint, A Dependency Directed Constraint Maintenance System, 1987.

No 72   **Tony Larsson:** On the Specification and Verification of VLSI Systems, 1986.

No 73   **Ola Strömfors:** A Structure Editor for Documents and Programs, 1986.

No 74   **Christos Levcopoulos:** New Results about the Approximation Behavior of the Greedy Triangulation, 1986.

No 104   **Shamsul I. Chowdhury: S**tatistical Expert Systems - a Special Application Area for Knowledge-Based Computer Methodology, 1987.

No 108   **Rober Bilos:** Incremental Scanning and Token-Based Editing, 1987.

No 111   **Hans Block:** SPORT-SORT Sorting Algorithms and Sport Tournaments, 1987.

No 113   **Ralph Rönnquist:** Network and Lattice Based Approaches to the Representation of Knowledge, 1987.

No 118   **Mariam Kamkar, Nahid Shahmehri:** Affect-Chaining in Program Flow Analysis Applied to Queries of Programs, 1987.

No 126   **Dan Strömberg:** Transfer and Distribution of Application Programs, 1987.

No 127   **Kristian Sandahl:** Case Studies in Knowledge Acquisition, Migration and User Acceptance of Expert Systems, 1987.

No 139   **Christer Bäckström:** Reasoning about Interdependent Actions, 1988.

No 140   **Mats Wirén:** On Control Strategies and Incrementality in Unification-Based Chart Parsing, 1988.

No 146   **Johan Hultman:** A Software System for Defining and Controlling Actions in a Mechanical System, 1988.

No 150   **Tim Hansen:** Diagnosing Faults using Knowledge about Malfunctioning Behavior, 1988.

No 165   **Jonas Löwgren:** Supporting Design and Management of Expert System User Interfaces, 1989.

No 166   **Ola Petersson:** On Adaptive Sorting in Sequential and Parallel Models, 1989.

No 174   **Yngve Larsson:** Dynamic Configuration in a Distributed Environment, 1989.

No 177   **Peter Åberg:** Design of a Multiple View Presentation and Interaction Manager, 1989.

No 181   **Henrik Eriksson:** A Study in Domain-Oriented Tool Support for Knowledge Acquisition, 1989.

No 184   **Ivan Rankin:** The Deep Generation of Text in Expert Critiquing Systems, 1989.

No 187   **Simin Nadjm-Tehrani:** Contributions to the Declarative Approach to Debugging Prolog Programs, 1989.

No 189   **Magnus Merkel:** Temporal Information in Natural Language, 1989.

No 196   **Ulf Nilsson:** A Systematic Approach to Abstract Interpretation of Logic Programs, 1989.

No 197   **Staffan Bonnier:** Horn Clause Logic with External Procedures: Towards a Theoretical Framework, 1989.

No 203   **Christer Hansson:** A Prototype System for Logical Reasoning about Time and Action, 1990.

No 212   **Björn Fjellborg:** An Approach to Extraction of Pipeline Structures for VLSI High-Level Synthesis, 1990.

No 230   **Patrick Doherty:** A Three-Valued Approach to Non-Monotonic Reasoning, 1990.

No 237   **Tomas Sokolnicki:** Coaching Partial Plans: An Approach to Knowledge-Based Tutoring, 1990.

No 250   **Lars Strömberg:** Postmortem Debugging of Distributed Systems, 1990.

No 253   **Torbjörn Näslund:** SLDFA-Resolution - Computing Answers for Negative Queries, 1990.

No 260   **Peter D. Holmes:** Using Connectivity Graphs to Support Map-Related Reasoning, 1991.

No 283   **Olof Johansson:** Improving Implementation of Graphical User Interfaces for Object-Oriented Knowledge-Bases, 1991.

No 298   **Rolf G Larsson:** Aktivitetsbaserad kalkylering i ett nytt ekonomisystem, 1991.

No 318   **Lena Srömbäck:** Studies in Extended Unification-Based Formalism for Linguistic Description: An Algorithm for Feature Structures with Disjunction and a Proposal for Flexible Systems, 1992.

No 319   **Mikael Pettersson:** DML-A Language and System for the Generation of Efficient Compilers from Denotational Specification, 1992.

No 326   **Andreas Kågedal:** Logic Programming with External Procedures: an Implementation, 1992.

No 328   **Patrick Lambrix:** Aspects of Version Management of Composite Objects, 1992.

No 333   **Xinli Gu:** Testability Analysis and Improvement in High-Level Synthesis Systems, 1992.

No 335   **Torbjörn Näslund:** On the Role of Evaluations in Iterative Development of Managerial Support Sytems, 1992.

No 348   **Ulf Cederling:** Industrial Software Development - a Case Study, 1992.

No 352   **Magnus Morin:** Predictable Cyclic Computations in Autonomous Systems: A Computational Model and Implementation, 1992.

No 371   **Mehran Noghabai:** Evaluation of Strategic Investments in Information Technology, 1993.

No 378   **Mats Larsson:** A Transformational Approach to Formal Digital System Design, 1993.

No 380   **Johan Ringström:** Compiler Generation for Parallel Languages from Denotational Specifications, 1993.

No 381   **Michael Jansson:** Propagation of Change in an Intelligent Information System, 1993.

No 383   **Jonni Harrius:** An Architecture and a Knowledge Representation Model for Expert Critiquing Systems, 1993.

No 386   **Per Österling:** Symbolic Modelling of the Dynamic Environments of Autonomous Agents, 1993.

No 398   **Johan Boye:** Dependency-based Groudness Analysis of Functional Logic Programs, 1993.

No 402	**Lars Degerstedt:** Tabulated Resolution for Well Founded Semantics, 1993.
No 406	**Anna Moberg:** Satellitkontor - en studie av kommunikationsmönster vid arbete på distans, 1993.
No 414	**Peter Carlsson:** Separation av företagsledning och finansiering - fallstudier av företagsledarutköp ur ett agent-teoretiskt perspektiv, 1994.
No 417	**Camilla Sjöström:** Revision och lagreglering - ett historiskt perspektiv, 1994.
No 436	**Cecilia Sjöberg:** Voices in Design: Argumentation in Participatory Development, 1994.
No 437	**Lars Viklund:** Contributions to a High-level Programming Environment for a Scientific Computing, 1994.
No 440	**Peter Loborg:** Error Recovery Support in Manufacturing Control Systems, 1994.
FHS 3/94	**Owen Eriksson:** Informationssystem med verksamhetskvalitet - utvärdering baserat på ett verksamhetsinriktat och samskapande perspektiv, 1994.
FHS 4/94	**Karin Pettersson:** Informationssystemstrukturering, ansvarsfördelning och användarinflytande - En komparativ studie med utgångspunkt i två informationssystemstrategier, 1994.
No 441	**Lars Poignant:** Informationsteknologi och företagsetablering - Effekter på produktivitet och region, 1994.
No 446	**Gustav Fahl:** Object Views of Relational Data in Multidatabase Systems, 1994.
No 450	**Henrik Nilsson:** A Declarative Approach to Debugging for Lazy Functional Languages, 1994.
No 451	**Jonas Lind:** Creditor - Firm Relations: an Interdisciplinary Analysis, 1994.
No 452	**Martin Sköld:** Active Rules based on Object Relational Queries - Efficient Change Monitoring Techniques, 1994.
No 455	**Pär Carlshamre:** A Collaborative Approach to Usability Engineering: Technical Communicators and System Developers in Usability-Oriented Systems Development, 1994.
FHS 5/94	**Stefan Cronholm:** Varför CASE-verktyg i systemutveckling? - En motiv- och konsekvensstudie avseende arbetssätt och arbetsformer, 1994.
No 462	**Mikael Lindvall:** A Study of Traceability in Object-Oriented Systems Development, 1994.
No 463	**Fredrik Nilsson:** Strategi och ekonomisk styrning - En studie av Sandviks förvärv av Bahco Verktyg, 1994.
No 464	**Hans Olsén:** Collage Induction: Proving Properties of Logic Programs by Program Synthesis, 1994.
No 469	**Lars Karlsson:** Specification and Synthesis of Plans Using the Features and Fluents Framework, 1995.
No 473	**Ulf Söderman:** On Conceptual Modelling of Mode Switching Systems, 1995.
No 475	**Choong-ho Yi:** Reasoning about Concurrent Actions in the Trajectory Semantics, 1995.
No 476	**Bo Lagerström:** Successiv resultatavräkning av pågående arbeten. - Fallstudier i tre byggföretag, 1995.
No 478	**Peter Jonsson:** Complexity of State-Variable Planning under Structural Restrictions, 1995.
FHS 7/95	**Anders Avdic:** Arbetsintegrerad systemutveckling med kalkylprogram, 1995.
No 482	**Eva L Ragnemalm:** Towards Student Modelling through Collaborative Dialogue with a Learning Companion, 1995.
No 488	**Eva Toller:** Contributions to Parallel Multiparadigm Languages: Combining Object-Oriented and Rule-Based Programming, 1995.
No 489	**Erik Stoy:** A Petri Net Based Unified Representation for Hardware/Software Co-Design, 1995.
No 497	**Johan Herber:** Environment Support for Building Structured Mathematical Models, 1995.
No 498	**Stefan Svenberg:** Structure-Driven Derivation of Inter-Lingual Functor-Argument Trees for Multi-Lingual Generation, 1995.
No 503	**Hee-Cheol Kim:** Prediction and Postdiction under Uncertainty, 1995.
FHS 8/95	**Dan Fristedt:** Metoder i användning - mot förbättring av systemutveckling genom situationell metodkunskap och metodanalys, 1995.
FHS 9/95	**Malin Bergvall:** Systemförvaltning i praktiken - en kvalitativ studie avseende centrala begrepp, aktiviteter och ansvarsroller, 1995.
No 513	**Joachim Karlsson:** Towards a Strategy for Software Requirements Selection, 1995.
No 517	**Jakob Axelsson:** Schedulability-Driven Partitioning of Heterogeneous Real-Time Systems, 1995.
No 518	**Göran Forslund:** Toward Cooperative Advice-Giving Systems: The Expert Systems Experience, 1995.
No 522	**Jörgen Andersson:** Bilder av småföretagares ekonomistyrning, 1995.
No 538	**Staffan Flodin:** Efficient Management of Object-Oriented Queries with Late Binding, 1996.
No 545	**Vadim Engelson:** An Approach to Automatic Construction of Graphical User Interfaces for Applications in Scientific Computing, 1996.
No 546	**Magnus Werner :** Multidatabase Integration using Polymorphic Queries and Views, 1996.
FiF-a 1/96	**Mikael Lind:** Affärsprocessinriktad förändringsanalys - utveckling och tillämpning av synsätt och metod, 1996.
No 549	**Jonas Hallberg:** High-Level Synthesis under Local Timing Constraints, 1996.
No 550	**Kristina Larsen:** Förutsättningar och begränsningar för arbete på distans - erfarenheter från fyra svenska företag. 1996.
No 557	**Mikael Johansson:** Quality Functions for Requirements Engineering Methods, 1996.
No 558	**Patrik Nordling:** The Simulation of Rolling Bearing Dynamics on Parallel Computers, 1996.
No 561	**Anders Ekman:** Exploration of Polygonal Environments, 1996.
No 563	**Niclas Andersson:** Compilation of Mathematical Models to Parallel Code, 1996.
No 567	**Johan Jenvald:** Simulation and Data Collection in Battle Training, 1996.
No 575	**Niclas Ohlsson:** Software Quality Engineering by Early Identification of Fault-Prone Modules, 1996.
No 576	**Mikael Ericsson:** Commenting Systems as Design Support—A Wizard-of-Oz Study, 1996.
No 587	**Jörgen Lindström:** Chefers användning av kommunikationsteknik, 1996.
No 589	**Esa Falkenroth:** Data Management in Control Applications - A Proposal Based on Active Database Systems, 1996.
No 591	**Niclas Wahllöf:** A Default Extension to Description Logics and its Applications, 1996.
No 595	**Annika Larsson:** Ekonomisk Styrning och Organisatorisk Passion - ett interaktivt perspektiv, 1997.
No 597	**Ling Lin:** A Value-based Indexing Technique for Time Sequences, 1997.

No 598   **Rego Granlund:** C^{3}Fire - A Microworld Supporting Emergency Management Training, 1997.
No 599   **Peter Ingels:** A Robust Text Processing Technique Applied to Lexical Error Recovery, 1997.
No 607   **Per-Arne Persson:** Toward a Grounded Theory for Support of Command and Control in Military Coalitions, 1997.
No 609   **Jonas S Karlsson:** A Scalable Data Structure for a Parallel Data Server, 1997.
FiF-a 4   **Carita Åbom:** Videomötesteknik i olika affärssituationer - möjligheter och hinder, 1997.
FiF-a 6   **Tommy Wedlund**: Att skapa en företagsanpassad systemutvecklingsmodell - genom rekonstruktion, värdering och vidareutveckling i T50-bolag inom ABB, 1997.
No 615   **Silvia Coradeschi**: A Decision-Mechanism for Reactive and Coordinated Agents, 1997.
No 623   **Jan Ollinen:** Det flexibla kontorets utveckling på Digital - Ett stöd för multiflex? 1997.
No 626   **David Byers:** Towards Estimating Software Testability Using Static Analysis, 1997.
No 627   **Fredrik Eklund:** Declarative Error Diagnosis of GAPLog Programs, 1997.
No 629   **Gunilla Ivefors:** Krigsspel coh Informationsteknik inför en oförutsägbar framtid, 1997**.**
No 631   **Jens-Olof Lindh:** Analysing Traffic Safety from a Case-Based Reasoning Perspective, 1997
No 639   **Jukka Mäki-Turja:**. Smalltalk - a suitable Real-Time Language, 1997.
No 640   **Juha Takkinen**: CAFE: Towards a Conceptual Model for Information Management in Electronic Mail, 1997.
No 643   **Man Lin**: Formal Analysis of Reactive Rule-based Programs, 1997.
No 653   **Mats Gustafsson**: Bringing Role-Based Access Control to Distributed Systems, 1997.
FiF-a 13 **Boris Karlsson:** Metodanalys för förståelse och utveckling av systemutvecklingsverksamhet. Analys och värdering av systemutvecklingsmodeller och dess användning, 1997.
No 674   **Marcus Bjäreland:** Two Aspects of Automating Logics of Action and Change - Regression and Tractability, 1998.
No 676   **Jan Håkegård**: Hiera rchical Test Architecture and Board-Level Test Controller Synthesis, 1998.
No 668   **Per-Ove Zetterlund**: Normering av svensk redovisning - En studie av tillkomsten av Redovisningsrådets rekommendation om koncernredovisning (RR01:91), 1998.
No 675   **Jimmy Tjäder**: Projektledaren & planen - en studie av projektledning i tre installations- och systemutvecklingsprojekt, 1998.
FiF-a 14 **Ulf Melin**: Informationssystem vid ökad affärs- och processorientering - egenskaper, strategier och utveckling, 1998.
No 695   **Tim Heyer**: COMPASS: Introduction of Formal Methods in Code Development and Inspection, 1998.
No 700   **Patrik Hägglund:** Programming Languages for Computer Algebra, 1998.
FiF-a 16 **Marie-Therese Christiansson:** Inter-organistorisk verksamhetsutveckling - metoder som stöd vid utveckling av partnerskap och informationssystem, 1998.
No 712   **Christina Wennestam:** Information om immateriella resurser. Investeringar i forskning och utveckling samt i personal inom skogsindustrin, 1998.
No 719   **Joakim Gustafsson:** Extending Temporal Action Logic for Ramification and Concurrency, 1998.
No 723   **Henrik André-Jönsson:** Indexing time-series data using text indexing methods, 1999.
No 725   **Erik Larsson:** High-Level Testability Analysis and Enhancement Techniques, 1998.
No 730   **Carl-Johan Westin:** Informationsförsörjning: en fråga om ansvar - aktiviteter och uppdrag i fem stora svenska organisationers operativa informationsförsörjning, 1998.
No 731   **Åse Jansson:** Miljöhänsyn - en del i företags styrning, 1998.
No 733   **Thomas Padron-McCarthy:** Performance-Polymorphic Declarative Queries, 1998.
No 734   **Anders Bäckström:** Värdeskapande kreditgivning - Kreditriskhantering ur ett agentteoretiskt perspektiv, 1998.
FiF-a 21 **Ulf Seigerroth:** Integration av förändringsmetoder - en modell för välgrundad metodintegration, 1999.
FiF-a 22 **Fredrik Öberg:** Object-Oriented Frameworks - A New Strategy for Case Tool Development, 1998.
No 737   **Jonas Mellin:** Predictable Event Monitoring, 1998.
No 738   **Joakim Eriksson:** Specifying and Managing Rules in an Active Real-Time Database System, 1998.
FiF-a 25 **Bengt E W Andersson:** Samverkande informationssystem mellan aktörer i offentliga åtaganden - En teori om aktörsarenor i samverkan om utbyte av information, 1998.
No 742   **Pawel Pietrzak:** Static Incorrectness Diagnosis of CLP (FD), 1999.
No 748   **Tobias Ritzau:** Real-Time Reference Counting in RT-Java, 1999.
No 751   **Anders Ferntoft:** Elektronisk affärskommunikation - kontaktkostnader och kontaktprocesser mellan kunder och leverantörer på producentmarknader,1999.
No 752   **Jo Skåmedal:** Arbete på distans och arbetsformens påverkan på resor och resmönster, 1999.
No 753   **Johan Alvehus:** Mötets metaforer. En studie av berättelser om möten, 1999.
No 754   **Magnus Lindahl:** Bankens villkor i låneavtal vid kreditgivning till högt belånade företagsförvärv: En studie ur ett agentteoretiskt perspektiv, 2000.
No 766   **Martin V. Howard:** Designing dynamic visualizations of temporal data, 1999.
No 769   **Jesper Andersson:** Towards Reactive Software Architectures, 1999.
No 775   **Anders Henriksson:** Unique kernel diagnosis, 1999.
FiF-a 30 **Pär J. Ågerfalk:** Pragmatization of Information Systems - A Theoretical and Methodological Outline, 1999.
No 787   **Charlotte Björkegren:** Learning for the next project - Bearers and barriers in knowledge transfer within an organisation, 1999.
No 788   **Håkan Nilsson:** Informationsteknik som drivkraft i granskningsprocessen - En studie av fyra revisionsbyråer, 2000.
No 790   **Erik Berglund:** Use-Oriented Documentation in Software Development, 1999.
No 791   **Klas Gäre:** Verksamhetsförändringar i samband med IS-införande, 1999.
No 800   **Anders Subotic:** Software Quality Inspection, 1999.
No 807   **Svein Bergum**: Managerial communication in telework, 2000.

No 809   **Flavius Gruian:** Energy-Aware Design of Digital Systems, 2000.

FiF-a 32   **Karin Hedström:** Kunskapsanvändning och kunskapsutveckling hos verksamhetskonsulter - Erfarenheter från ett FOU-samarbete, 2000.

No 808   **Linda Askenäs:** Affärssystemet - En studie om teknikens aktiva och passiva roll i en organisation, 2000.

No 820   **Jean Paul Meynard:** Control of industrial robots through high-level task programming, 2000.

No 823   **Lars Hult:** Publika Gränsytor - ett designexempel, 2000.

No 832   **Paul Pop:** Scheduling and Communication Synthesis for Distributed Real-Time Systems, 2000.

FiF-a 34   **Göran Hultgren:** Nätverksinriktad Förändringsanalys - perspektiv och metoder som stöd för förståelse och utveckling av affärsrelationer och informationssystem, 2000.

No 842   **Magnus Kald:** The role of management control systems in strategic business units, 2000.

No 844   **Mikael Cäker:** Vad kostar kunden? Modeller för intern redovisning, 2000.

FiF-a 37   **Ewa Braf**: Organisationers kunskapsverksamheter - en kritisk studie av "knowledge management", 2000.

FiF-a 40   **Henrik Lindberg:** Webbaserade affärsprocesser - Möjligheter och begränsningar, 2000.

FiF-a 41   **Benneth Christiansson:** Att komponentbasera informationssystem - Vad säger teori och praktik?, 2000.

No. 854   **Ola Pettersson:** Deliberation in a Mobile Robot, 2000.

No 863   **Dan Lawesson**: Towards Behavioral Model Fault Isolation for Object Oriented Control Systems, 2000.

No 881   **Johan Moe:** Execution Tracing of Large Distributed Systems, 2001.

No 882   **Yuxiao Zhao:** XML-based Frameworks for Internet Commerce and an Implementation of B2B e-procurement, 2001.

No 890   **Annika Flycht-Eriksson:** Domain Knowledge Management inInformation-providing Dialogue systems, 2001.

Fif-a 47   **Per-Arne Segerkvis**t: Webbaserade imaginära organisationers samverkansformer, 2001.

No 894   **Stefan Svarén:** Styrning av investeringar i divisionaliserade företag - Ett koncernperspektiv, 2001.

No 906   **Lin Han**: Secure and Scalable E-Service Software Delivery, 2001.

No 917   **Emma Hansson:** Optionsprogram för anställda - en studie av svenska börsföretag, 2001.

No 916   **Susanne Odar:** IT som stöd för strategiska beslut, en studie av datorimplementerade modeller av verksamhet som stöd för beslut om anskaffning av JAS 1982, 2002.

Fif-a-49   **Stefan Holgersson:** IT-system och filtrering av verksamhetskunskap - kvalitetsproblem vid analyser och beslutsfattande som bygger på uppgifter hämtade från polisens IT-system, 2001.

Fif-a-51   **Per Oscarsson:**Informationssäkerhet i verksamheter - begrepp och modeller som stöd för förståelse av informationssäkerhet och dess hantering, 2001.

No 919   **Luis Alejandro Cortes:** A Petri Net Based Modeling and Verification Technique for Real-Time Embedded Systems, 2001.

No 915   **Niklas Sandell:** Redovisning i skuggan av en bankkris - Värdering av fastigheter. 2001.

No 931   **Fredrik Elg:** Ett dynamiskt perspektiv på individuella skillnader av heuristisk kompetens, intelligens, mentala modeller, mål och konfidens i kontroll av mikrovärlden Moro, 2002.

No 933   **Peter Aronsson:** Automatic Parallelization of Simulation Code from Equation Based Simulation Languages, 2002.

No 938   **Bourhane Kadmiry**: Fuzzy Control of Unmanned Helicopter, 2002.

No 942   **Patrik Haslum:** Prediction as a Knowledge Representation Problem: A Case Study in Model Design, 2002.

No 956   **Robert Sevenius:** On the instruments of governance - A law & economics study of capital instruments in limited liability companies, 2002.

FiF-a 58   **Johan Petersson:** Lokala elektroniska marknadsplatser - informationssystem för platsbundna affärer, 2002.

No 964   **Peter Bunus:** Debugging and Structural Analysis of Declarative Equation-Based Languages, 2002.

No 973   **Gert Jervan:** High-Level Test Generation and Built-In Self-Test Techniques for Digital Systems, 2002.

No 958   **Fredrika Berglund:** Management Control and Strategy - a Case Study of Pharmaceutical Drug Development, 2002.

Fif-a 61   **Fredrik Karlsson:** Meta-Method for Method Configuration - A Rational Unified Process Case, 2002.

No 985   **Sorin Manolache:** Schedulability Analysis of Real-Time Systems with Stochastic Task Execution Times, 2002.

No 982   **Diana Szentiványi:** Performance and Availability Trade-offs in Fault-Tolerant Middleware, 2002.

No 989   **Iakov Nakhimovski:** Modeling and Simulation of Contacting Flexible Bodies in Multibody Systems, 2002.

No 990   **Levon Saldamli:** PDEModelica - Towards a High-Level Language for Modeling with Partial Differential Equations, 2002.

No988   **Mattias Arvola:** Good to use! : Use quality of multi-user applications in the home, 2003.