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Shades of Use: The Dynamics of Interaction Design for Sociable Use

by

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Abstract

Computers are used in sociable situations, for example during customer meetings. This is seldom recognized in design, which means that computers often become a hindrance in the meeting. Based on empirical studies and socio-cultural theory, this thesis provides perspectives on sociable use and identifies appropriate units of analysis that serve as critical tools for understanding and solving interaction design problems. Three sociable situations have been studied: customer meetings, design studios and domestic environments. In total, 49 informants were met with during 41 observation and interview sessions and 17 workshops; in addition, three multimedia platforms were also designed. The empirical results show that people need to perform individual actions while participating in joint action, in a spontaneous fashion and in consideration of each other. The consequence for design is that people must be able to use computers in different manners to control who has what information. Based on the empirical results, five design patterns were developed to guide interaction design for sociable use. The thesis demonstrates that field studies can be used to identify desirable use qualities that in turn can be used as design objectives and forces in design patterns. Re-considering instrumental, communicational, aesthetical, constructional and ethical aspects can furthermore enrich the understanding of identified use qualities. With

a foundation in the field studies, it is argued that the deliberation of dynamic characters and use qualities is an essential component of interaction design. Designers of interaction are required to work on three levels: the user interface, the mediating artefact and the activity of use. It is concluded that doing interaction design is to provide users with perspectives, resources and constraints on their space for actions; the complete design is not finalized until the users engage in action. This is where the fine distinctions and, what I call 'shades of use' appear.

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Contents

1. Introduction

People frequently use computers together in sociable face-to-face situations, but they are often not designed for such situations at which they can hamper the social interaction. This thesis highlights shades and aspects of sociable use and use qualities in order to, by empirical work, develop concepts for interaction design. It contributes with a discussion on what the appropriate units of analysis are for interaction design and it describes different granularities of what interaction design means, what it can be, and how to go about doing it. A mediated perspective building on a socio-cultural tradition of ideas is explicitly taken.

The focus of the research is on sociable face-to-face situations of use where cooperation and community is important, and it particularly looks at customer meetings, design studios, and multimedia platforms in the home. Such situations of use can be contrasted to situations where someone works mainly individually by a computer connected to a network. Sociable face-to-face situations are interesting in that they often are neglected in interaction design. When applications designed for individuals are used in sociable situations they can interrupt the social interaction among people. Sociable situations of use have, furthermore, a wider range of contextual, social and cultural

design issues than design for individual use has. They are therefore particularly interesting.

This thesis does not claim to offer all components needed for high-quality interaction design. On the individual scale, it takes, among other things, sensibility in the judgment of design alternatives, divergent and holistic thinking, and familiarity with the material of interactive systems. On the organisational scale, it calls for careful orchestration of many different competencies and processes. Neither of these things can be learned from a textbook such as this thesis. In addition, the many possible sources of inspiration and reflection make it impossible to write a thesis on interaction design without being highly selective. It is, nevertheless, my hope that this thesis will provide some significant insights to interaction design and hopefully provide several models for thought and reflection. Even though interaction design cannot be learned from a book, the concepts in this book can help designers to reflect on their practice and hence open up for learning and adaptation.

Practicing and researching interaction designers need a wide variety of concepts that they can use to describe and analyse the use of the products that they are designing or studying. Too few concepts may make researchers and designers of human-computer interaction (HCI) insensitive to the shades and nuances of the situation and the uniqueness of every design case. Some language of interaction design is indeed necessary, and commonly used concepts like usability, learnability, effectiveness, efficiency, user satisfaction, and consistency are part of that. They help in making different qualities of systems-in-use visible and they allow us to compare products by discussing their properties, but other aspects of systems-in-use are also important and need to be highlighted (Löwgren & Stolterman, 1998; Bratteteig & Stolterman, 1997; Levén & Stolterman, 1995; Cross, 1995; Stolterman, 1991; Lawson, 1980).

The knowledge interest of this thesis is, in a broad sense, to expand our understanding of the characteristics that interactive systems display in use, as well as putting that understanding in a form that is applicable in interaction design research, education and practice. Judging the goodness of a design solution is a key activity in interaction design and in order to do so we need concepts for articulating and

reflecting on the characteristics interactive systems have in their use. In relation to architecture, Saunders (2001, p. 2) writes:

> And what if one called time-out and examined implicit criteria in journalistic architectural criticism?
> Or at a public review of a design for a city plaza?
> At a board meeting held to choose among designs for corporate tower?
> […]
> In a conversation of a couple selecting a house from among several?
> In all these situations, evaluations are expressed, more or less carefully and self-consciously. And in all, analyses of judgments would be illuminating—the opportunities for questioning, refining and changing operative criteria would be vast.

This thesis is about judgements, not of architecture, but of interactive systems. Tools for articulation of and reflection on judgements can open up for questioning, refinement and change of the criteria employed, and even more importantly recognizing the ones not employed.

In order to set the frame for this work, the nature of design and the emerging tradition of use-oriented interaction design as I have come to know it will be described in this first chapter.

1.1. Design in Practice

Theories and methods presented in this thesis are to be considered as "thinking devices" 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 make explorative moves and assess the consequences. Doing things in the real world is, however, expensive and potentially dangerous if you do not know what will happen. Designers therefore create a model 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 in the form of talk, sketches, graphs, and other design artefacts produced during the design process.

Design is, however, not only the drawing of objects that then are built or manufactured. It is also the process of devising whole systems such as airports, transportation, banking systems, welfare schemes et cetera. It is furthermore the creative participation of many different interests and competences. (Jones, 1992)

Design Problems

It is quite common to view design as problem solving. For example, Herbert Simon (1969, p. 55) conceptualized design as a process of devising courses of action aimed at "changing existing situations into preferred ones." According to him, this can be achieved by using utility theory and statistical decision theory to make a rational choice among given alternatives and find the optimum solution. He recognized that this would require full knowledge about the world, which would not be possible and hence we need to search for a satisfactory solution to the problem rather than the optimum. To Simon design is a search in a problem space of alternatives; design becomes an optimization problem. Now, there are at least two problematic assumptions behind this view. Firstly, it assumes that design problems are given. Secondly, it assumes that there are objective and quantifiable criteria for the choice among alternatives. It is, as Ehn (1988) points out, questionable if the creativity of professional designers and users is reducible to formal decision-making, and if the social and historical character of the design process with its interest conflicts, and differences in skill, experiences and professional languages can be accounted for by formal logic, mathematics and statistics.

In fact, design problems are never given; instead they must be "constructed from messy problematic situations (Schön, 1983, p. 47)." Design problems can be classified as wicked (Rowe, 1987), which means that it is not possible to define them precisely. You cannot say exactly what the problem is, it is always disputable and new questions can be posed that reformulates the problem. There are no obvious rules for stopping the design process. 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 one initially suggested solution. It depends on how the problem is framed (Schön, 1983).

Designers find themselves in a problematic situation that has to be explored. During this exploration the design problem and its alterna-

tive solutions are defined together in a tight coupling. Design is hence a process of problem setting as much as it is a process of problem solving (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. Design is to find the solution as well as the problem in a problematic situation, as illustrated in Figure 1.1.

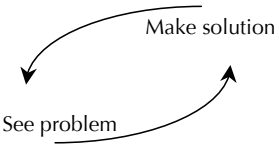

Figure 1.1: The problem-solution loop in design work.

Nelson and Stolterman (2003) argue that we should not see design as problem solving, or problem setting for that matter. Thinking about design as solving problems will focus us on avoiding undesirable states. They instead urge us to see it as the application of design wisdom, which will focus us on intentional actions that lead to desirable and appropriate states. In design there is no such thing as a true or false solutions, there are only good or bad compositions. In their terms, we would say that the understanding of tensions in the design situation develops together with the development of compositions, rather than saying that the solution and the problem is co-evolving. In their view, designers as well as the clients have an unarticulated view of an ideal situation and the discrepancy between this ideal and the pragmatic compositions that the designers produce is what is perceived as the "design problem."

Winograd (1996, p. xx) sees the design activity as looking "for creative solutions in a space of alternatives that is shaped by competing values and resource needs." The values and needs are always in competition or negotiation, and claims can often be made for one solution as well as for another. A designer needs to strike trade-offs between them (Carroll, 2000). A continuous dialectic relation between creating and judging is consequently imperative for the success of a design project. When a composition, finally, is recognized to meet the needs and desires of the various stakeholders it can be developed further into a specified design solution.

Nelson and Stolterman use the metaphor of design as being in service. They argue that design is defined by a service relationship where design activities are animated through dynamic relationships between those being served (clients, customers and users) and those who are in service (i.e. designers). They stress that this does not mean that designers are servants, or that they are facilitators on behalf of other's needs. Nor does it exclude self-expression, but it is not the

dominant objective. The success of a design is, in their eyes, best determined when those who are served experience the surprise of self-recognition: getting the expected and desired outcome while being surprised with the unexpected.

Clients may not completely know what is desired at the beginning of a design project, they are only aware that "something is pressing for expression (Nelson & Stolterman, 2003, p. 49)." If you are in service, you are pro-active and take the client's originally expressed desiderata (that-which-is-desired) and bring tensions of wants, needs, and fears to the surface in order to pro-actively make an intentional change that is in service. A designer hence needs to determine the underlying intentions of a client's desiderata in order to concretely conceptualize them to go beyond the client's expectations, knowledge and imagination.

Outlining the Design Process

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 depicted in Figure 1.2. During the divergent phase the constraints and possibilities of the design situation are explored. The designers try to find facts in the design situation that are stable so that they can hold on to them in the design process. Large parts of this phase consist 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 at this stage small and the details are being polished.

Stolterman's outline (Stolterman, 1991; Bratteteig & Stolterman, 1997; and Löwgren & Stolterman, 1998) is similar to Jones's. He calls the three activities vision, operative image and specification, as shown in Figure 1.3. The three activities are mutually dependent and all present at the same time throughout the design process. But earlier stages of a project carry more of a visionary phase, the middle relies heavier

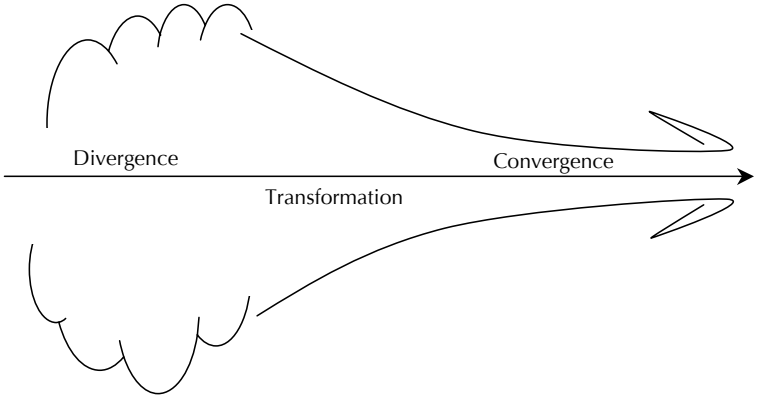

Figure 1.2: The phases of the design process, according to Jones.

on the operative image and the final part is more dependent on the design specification.

In recent work by Stolterman together with Nelson (Nelson & Stolterman, 2003) the vision is not thought of as a starting point for design. The starting points are instead the initially expressed desiderata, the service relationship between designer and other stakeholders, and the designer's appreciative judgment. The vision is rather conceived as an outcome of creative leadership of participative design efforts that lead up to the breakthrough insight, characterized by an ah-ha experience. This insight is called 'the parti' and it is the core of what will be developed into the vision. It is an initial crystallization of an idealized design solution to a complex design challenge, and from this formative ideal a mature design concept can grow. The ideal design solution in the form of the parti cannot be understood, judged or communicated without being transformed into images or schemes.

The Role of Externalisation

Sketching is an important tool for doing divergent and transformative design. In fact, as argued by Gedenryd (1998), designers go out of their way avoiding intra-mental thinking and instead use sketches to restore presence so that they can work interactively by seeing and doing in the medium of the sketch. The sketch is a model that designers use to be able to conceive and predict the consequences of a certain design move. Representational means such as sketches, diagrams or other physical models are important tools for design since they help in assessing and reflecting on the details of a solution in relation to the

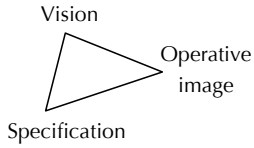

Figure 1.3: The abstraction levels of the design process, according to Stolterman.

whole problematic context in which it is situated. Using pencil and paper speeds up the doing-seeing loop of creation, judgement and reformulation. Few other tools are as fast as pencil and 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 in that 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) calls "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. Schön writes:

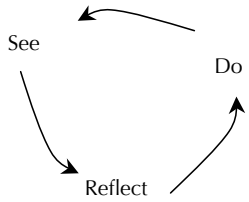

Figure 1.4: Reflection-in-action.

> 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 form a documentation of the design process without adding any administrative overhead. Designers can learn much by browsing back in old sketches (Schön, 1983).

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 also to persuade the other part that a particular design alternative is better than other alternatives.

As noted above, the sketch can be rapid and spontaneous, but it leaves stable traces in contrast to talk, which is evanescent (Clark & Brennan, 1991). Talk is, however, important for the argumentative assessment and communication of design alternatives, which also is at

the core of design activities. Designers employ a language of talking and drawing in parallel. Schön (1983, p.94; 1987, p.57) describes the work of an architectural design teacher called Quist in a session with a student:

> "In the media of sketch and spatial-action language, he represents buildings on the site through moves which are also experiments. Each move has consequences described and evaluated in terms drawn from one or more design domains. Each has implications binding on later moves. And each creates new problems to be described and solved. Quist designs by spinning out a web of moves, consequences, implications, appreciations, and further moves."

The citation above is a clear statement of what much of design work is about. In terms of distributed cognition (e.g. Hutchins, 1995; Hollan, Hutchins & Kirsch, 2000; Garbis, 2002), it describes design work as distributed over designers and their representational means (e.g. sketches). The representational means are, in turn, physical embodiments of the culture and history in which they have evolved. The cultural practices of designers, including the spatial-action language, provide therefore the structural resources for performing experimental design moves. It is part of their knowing-in-action; the know-how revealed in spontaneous and skilfully performed actions (Schön, 1983, 1987). The spatial-action language is also constitutive of their professional community of practice (Wenger, 1998), in the ways in which they communicate.

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 online training for an interactive system. The material is set to be HTML and perhaps Macromedia Authorware. This controls what the designers can do and how they perceive the problem. There are some things the designers cannot even imagine to do. They do, for instance, not consider interactive 3D-visualisation of a database. To give another example, if it is decided to build a computer game in 3D, the designers

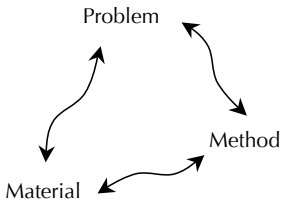

Figure 1.5: The mutual dependency between material, method and problem.

have decided what the problems are: for example, modellers and animators are needed rather than a HTML-coder.

When designers decide which method to use (i.e. how to approach the design work), 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 between 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 it 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 prescribed procedure of how 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 his or her 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 problems are framed and they also embody the designer's knowledge of the design material. A designer who has worked only with web projects has a repertoire of examples from the web, but has also knowledge in design materials like HTML, DHTML, Flash, JavaScript, PHP 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. Perhaps that designer makes a navigation structure from one screen to another rather than using a pop-up window. The material, the method and the problem are in practice tightly intertwined.

Motive, Focus and Problem Framing

The motive for design, the focus for design and the problem framing are, just like the material, the method and the problem, highly interdependent.

All the different stakeholders in a design project enter it with a certain motive, to fulfil a desideratum. Different designs will be achieved depending on which motives that are expressed in the dialogue of the project. For instance, a buyer may enter a project with the motive of getting things done more in a faster pace. The software designer may answer with a faster computer. The user may in turn want it to be fast in its use.

These different motives may lead to that different stakeholders focus the design effort on different things. The objects of design are different. The software designer designs the computer system, someone else may focus on designing the activity of using the system, a third person in a project thinks that they are designing good interaction between the computer and the human, a fourth stakeholder is in fact redesigning the organisation by getting a new technology. These differences in what the focus for the design effort is will cause every stakeholder in the project to frame the design problem differently and this must be articulated as the desiderata are developed into a vision.

1.2. Use-Oriented Interaction Design

This chapter has so far outlined my understanding of the nature of the design process in general. The remainder of this chapter focuses on the process of composing the use of interactive systems, in other words interaction design, which is a design discipline. Other design disciplines would include architectural design, industrial design and graphic design, but also learning design and organisation design. To put it simply, interaction design is the design discipline that deals with the design of interactive systems. It is a process that under temporal and economical restrictions is managed in order to specify the properties of an interactive system (see also Löwgren & Stolterman, 1998).

Interactive Systems

So what is an interactive system? First of all it is a system, and in the particular sense in which the term is used in this thesis it is short for a computer-based system. If I were to express myself clearly I would

search every instance of the term 'interactive system' in this thesis and replace it with the term 'interactive computer-based system.' [1]

The term 'system' has had many meanings ascribed to it throughout the years. In Simon's (1969, p. 76) version of systems engineering a complex system is "made up by a large number of parts that interact in a nonsimple way." The whole of a system cannot be reduced to its parts without loosing something. It is not decomposable without relating the components back to the whole. Relating parts of a system to the whole is essential to design (Bernstein, 1988).

Ackoff and Emery (1972, in Nelson & Stolterman, 2003, p. 96) define a system as:

> …a set of interrelated elements, each of which is related directly or indirectly to every other element, and no subset of which is unrelated to any other subset.

Ackoff and Emery continues by stating that a system is an entity composed of at least two elements and a relation that holds between each of the elements and at least one other element in the set.

Checkland (1999, p. 13–14) writes in the following way about the notion of systems and their relation to subsystems:

> The systems paradigm is concerned with wholes and their properties. It is holistic, but not in the usual (vulgar) sense of taking in the whole; systems concepts are concerned with wholes and their hierarchical arrangement rather than with *the* whole.

A system where all parts is in a dynamic and interactive in relation to the other elements is complex. Everything exists in a context of something else, and the properties of the system or component under study are dependent on its environment. This is also the case for computer-based systems. A computer system is only a functional assembly of software and hardware, until it is experienced as for example a word processor. The functions of the components must be understood in relation to the purpose of the whole, which makes the system meaningful.

Systems are by nature complex as well as interactive. When the surrounding environment affects the system or a component, it will react and propagate as well as respond and thus produce interactivity.[2]

1. See the glossary at the end of the thesis of further clarifications.

2. This idea of an open system can be contrasted to the notion of a closed system that does not exchange anything with its environment.

I follow Svanæs (2000) in his definition of interactivity in the context of HCI. Interaction in HCI involves at least two participants and at least one participant is human and at least one is computer-based. An interactive system is in this thesis conceptualized as a computer-based system that allows for interaction through, with and by means of the computer. Interaction denotes in turn action that is performed mutually and reciprocally in close contact between several parties (for example a user and a computer).

However, if systems are interactive by definition why do I use the adjective 'interactive' in front of the noun 'system'? Well, because I wish to emphasize that the focus of this thesis is not on the computer-based system in itself, but rather on the interactions within the joint system of human actors and computer-based systems, as well as on the interactions between that joint system and its environment. As earlier stated the focus is on use, where use is conceptualized as the interactions through, with and by means of the computer-based system.

Interaction Design as Design of Use

Interaction design is often seen as the process of specifying the properties of an interactive system and often it is used as a new and trendy name for user interface design. Löwgren (2002) writes:

> There is no commonly agreed definition of interaction design; most people in the field, however, would probably subscribe to a general orientation towards shaping software, websites, video games and other digital artifacts, with particular attention to the qualities of the experiences they provide to users.

The properties of an interactive system and the experiences they provide to users are, however, emergent in use where the computer-based system interacts with its environment. This leads Löwgren (2002, p. 32) to defining interaction design as the "shaping of interactive systems with particular emphasis on their use qualities." Use qualities are the characteristics that the interactive systems display in use. Interaction design is, to Löwgren, not only to design the interaction potentials between user and system. Indirectly it also means shaping the user to some extent, since the actual use is mediated by the system-which-is-designed.

Winograd adheres to this wider view of interaction design. He also lifts the focus from the interaction between the system and the use. He says in an interview (Preece, Rogers & Sharp, 2002, p. 70):

> So I think interaction design is about designing a space for people, where that space has to have a temporal flow. It has to have a dialogue with the person.

Buchanan (2001, p. 11) describes interaction design in the following way:

> We call this domain "interaction design" because we are focusing on how human beings relate to other human beings through the mediating influence of products. And the products are more than physical objects. They are experiences or activities or services, all of which are integrated into a new understanding of what a product is or could be.

Let me illustrate this broader perspective with an example of two kids playing Monopoly. The designers of the game can either be seen as designing the artefact in itself: the board, the rules, the pieces and the cards. In a computer-based version, there are representations of all these on screen and both the board and the pieces are semi-autonomous. The designers are, however, also thinking about game play and emergent properties of the game like luck, skill, fun, conviviality and excitement. These are not properties of the artefact as such, but are instead emergent in the sociable use between the kids. The designers also want to incorporate the original ideas of making Monopoly into a comment on the financial world not of the 1930's, but of today. This is part of the their motive. It is, however, not part of their motive to design the game to make the kids learn the names of streets and places (even though this is an important side effect).

Interaction design is accordingly the design of the use of an interactive system rather than the design of an interactive system per se. This means that interaction design would include not only the design of the user interface and the interaction with the system (the narrow conceptualisation of interaction design), but also the interaction with some material through the interactive system, and the use of that material in communication and interaction with the world and with other

people (see Figure 1.6). For example, when doing the interaction design for a photo editor the interaction designer not only designs the user interface and the interaction with the application, but also designs the behaviour of the pixel-based image (the material), and how that product can be used in interaction with other people who in turn use the same or another application to view or edit the image.

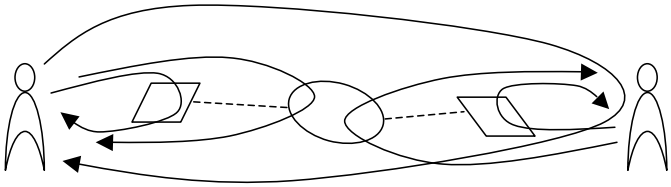

Figure 1.6: The design object of interaction design—the interaction with, through and by means of the interactive system.

The designer usually does not have authority to design all parts he or she wishes to affect. Usually he or she has control over the design of the interactive system, and this is what is primarily designed. Secondarily the designer, however, also designs the entire situation of use. This means interaction design deals with *second-order design problems* (Salen & Zimmerman, 2004): the designer manipulates properties of the interactive system but wishes to affect properties in the activity of use, such as the experience of using the system

Since the designers never can be sure what will happen in use and cannot *control* it, but only structure it, the models for thought that he or she utilizes to conceptualise the use become important guides. When it comes to design as not only deciding the appearance of things John Chris Jones (1992, p. xxxiv) wrote:

> A potter modelling a piece of clay into the 'perfect' shape for a cup is an ancient, and I think unhelpful, metaphor for the process of designing. When design was limited to the shaping of objects it perhaps sufficed, but now, when the scale has grown to that of systems of objects, and the activities of people, the metaphor has become destructive. We are not clay, not infinitely malleable, not dead. What is the right metaphor now?

This thesis addresses Jones' question by investigating what the appropriate unit of analysis and the appropriate design object of interaction design is.

This thesis argues that, interaction design is the design of the purposeful interactions performed with, through and by means of a computer-based system; it is the design of how the product is used within different environments or situations, for example how it is supposed to be used in the school, on the aeroplane, at the office, at home, etc. The process of interaction design is not over until the practices of using the system and the interaction patterns have settled.

The usage of an interactive system consists of users that are doing things by means of the computer for reaching some goals at a certain time and at a certain place. All of these (users, computers, actions, goals and context) may be designed or changed in an interaction design process. Even though the focus usually is on designing the computer-based systems and the actions performed with them, all other aspects of the usage will be affected by the design and are consequently also designed. The usage of the computer can furthermore in itself be viewed as a system: a mediated activity system (see Chapter 2).

I have outlined what the practice 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 must fit into a designerly work practice and a designerly thinking. I have so far stated what I understand the term 'interactive system' to mean, as well as described how interaction design can be viewed as the design of use of interactive systems. It is my goal that the theories and methods addressed in this thesis should work as models for thought, reflection and articulation for practising and researching interaction designers.

Use-Oriented Design

Use-oriented design is slightly different in focus from the more often referred to notion of user-centred design (or user-oriented design). The latter focuses on users, while the former includes the change of practices and business, and the perspective of the procurer of the interactive system is as important as that of the user (see for example Artman, 2002). Use-orientation also includes the usefulness of the interactive system in relation to the teleological aims of the system (Howard, 2002a). The difference between the two approaches can best be illustrated by two questions. As implied by the name, user-orientation, on the one hand, starts out with the basic question of who the user is. Use-orientation, on the other hand, starts out with the question of

what the use is. Just like with the definition of what the object for design is in interaction design, this has to do with deciding the appropriate unite of analysis, in a similar fashion as it has been discussed in HCI and cognitive science by for example Nardi (1996), Wertsch (1998) and Hutchins (1995).

While user-orientation aims at understanding and designing for users, use-orientation aims at understanding and designing for the activity and practice of use. A problem with user-orientated design is that the notion of the user is not problemized (Ehn & Löwgren, 1997). Who is really the user of a system? Is it a representative person in statistical or pragmatical sense, an individual in a unique context, a person in a collaborative setting, a component in a work system, an organization, a stakeholder, an end-user, an organization representing users or a customer? The concept of the user is problematic in itself (Bannon, 1991). [3]

In the first sentence of the prologue to his book "Work-Oriented Design of Computer Artifacts," Pelle Ehn (1988, p. 3) writes:

> Computers and coffee machines are perhaps the two most striking artifacts of a Scandinavian workplace today. To understand these artifacts we have to understand how people at work use them.

This is what the entire tradition of use-oriented design boils down to: Understanding the use of artefacts and its tradition, and transcending that to create something even better. From the perspective of participatory design and democracy at work, Ehn focused on situations of work but a use-oriented approach has been taken in other domains as well (e.g. Petersen, Madsen & Kjær, 2002; O'Brien, Rodden, Rouncefield & Hughes, 2000). The basis for research into use-oriented design is that "*human practice and understanding in everyday life should be taken as the ontological and epistemological point of departure in inquiries into design and use of computer artefacts.*" (Ehn, 1988, p. 28, emphasis in original)

Socio-cultural theories as well as phenomenology have been influential in the tradition of use-oriented design. Bødker has for example made use of both Heidegger's phenomenology and activity theory (Bødker, 1989, 1996). She stresses, just like Ehn, the relationship between the design of the interactive system and the use activity, and

3. I have argued elsewhere (Blomquist & Arvola, 2002; Arvola, forthcoming) that the use of non-real characters called 'personas' that are based on empirical material and that represent the user to the design team in an imaginative and evocative fashion potentially can assist in getting around the problem.

how difficult it is for an outside observer to interpret what happens in the situation of use. This issue can be addressed by the use of cooperative techniques where users take active part in the process of design. Given the dependency between the specific design and the specific situation of use, generally applicable design guidelines are difficult to give and their applicability must be re-considered in every new situation of use. It is not before an interactive system is in use that its qualities are disclosed. The introduction of a new interactive system into a practice will reshape the whole practice, including users who need to go through a learning process. Bødker (1989, p. 193) writes:

> To design an artifact means not only to design the artifacts for a specific kind of activity. Because the use of artifacts is part of social activity, we design new conditions for collective activity (e.g., new division of labor and other ways of coordination, control, and communication).

Bannon and Bødker (1991) emphasize this view further in their argument that the artefact only reveals itself fully to us when it is in use as the usage develops over time. They suggest that a theory of HCI should take its point of departure in the praxis of a certain community, and they point towards researchers such as Lave (1988), Suchman (1987), and Winograd and Flores (1986) to complement their own use of socio-cultural activity theory.

The use-oriented approach is today very strong in the Scandinavian tradition of information systems development. In Sweden there has even been a change of name of the field from 'administrative data processing' to 'informatics' to denote a shift of focus. Dahlbom (1997) writes in his article The New Informatics:

> Rather than going on about "developing information systems" we are beginning to speak of our discipline in terms of "using information technology."

At the end of his article where he outlines the new informatics curriculum in Sweden he writes:

> Informatics, as I understand it, is a discipline tracking (leading) the development of information technology, with the ambition to

> put that technology to good use, acting both on the technology and on the organization of its use.

The focus on the praxis of use activities is, however, not only a Scandinavian affair. There is also a tradition of ethnography (and ethnomethodology in particular) in computer-supported cooperative work (CSCW). The focus of ethnography for design purposes within that tradition is on the social organization of work, on the use of artefacts and on communication, coordination and cognition in everyday life situations (e.g. Suchman, 1987; Hughes, King, Rodden & Andersen, 1995; Luff & Heath, 1998; Hollan, Hutchins & Kirsch, 2000).

Carroll (1995) argues that we have little prospect at finding any final answers to questions regarding the nature of human activity. We should, according to his view, aim at developing rich and flexible methods and concepts for integrating descriptions of potential users and the uses of an envisioned system with the design of that system. He furthermore argues that we need to develop new vocabularies for discussing and characterizing designs in terms of the projected activities of intended users. In order to represent usage in the design process Carroll (1995, 2000), among others, have worked with scenarios as use-oriented design representations. Other common design artefacts and representations would include for example computer-based and paper-based prototypes (e.g. Houde & Hill, 1997). With scenario-based design, Carroll (2000) is on the way to develop a full-fledged use-oriented design methodology based on the concept of scenarios as representations of use.

Not all that different from Carrolls approach is contextual design as described by Beyer and Holtzblatt (1997). It is a number of analysis and design activities coordinated by vision scenarios where both system designers and customers participate. The goal of contextual design is to create systems that match the customers' needs, desires and approaches to work.

In Ehn and Löwgren's (1997) characterization of use-centred systems development they view it as a process oriented towards achieving quality-in-use. In order to design for quality-in-use a designer need to consider at least three quality perspectives holistically: constructional quality for the structure, ethical quality for the function and aesthetical quality for the form. Löwgren and Stolterman (1998) describe that the

goodness of an interactive system must be judged in relation to its user and his or her needs, as well as other stakeholders in different situations with different purposes and expectations. Good design is defined in the interaction with society in general, including laws, legislations, agreements and norms. It is furthermore decided by basic ideological positions like democracy, culture and care for the environment. In this incredibly complex situation, the designer must fall back on his or her judgement of design alternatives. The judgement of goodness is based on an individual stance where the designer takes into account all the aforementioned aspects. Much of what design skills is made up by is related to this process of judging the goodness of alternatives.

Holmlid (2002) have suggested an approach to developing the skill of judgement in interaction design and providing structuring resources to designers in the form of models of use quality. His idea is that you start with identifying the characteristics that make an interactive system good too use, its desirable use qualities. This is a prescriptive approach, but you can also take a descriptive approach and identify the qualities an interactive system has in its use and from that pose the question of which of those qualities that are good and bad (a critical approach). This activity will in the end produce models of use qualities for that particular interactive system, and based on those models the designers can give the system form in accordance to how it is put to use.

Holmlid's approach is quite similar to Hult's (2003) approach, where the use quality models are seen as repertoires of use qualities. Hult sees a repertoire as applicable to a certain genre of artefacts such as for example the Internet-based encyclopaedia. This will allow for transfer of design knowledge between artefacts within a genre.

1.3. Aim of the Thesis

This thesis aims at specifying appropriate units of analysis in interaction design for sociable situations of use. It also aims at gathering an empirical foundation for discussing interaction design for sociable use in terms of concepts and models for thought such as genres, use qualities, design patterns, and scenarios that can highlight shades in the complex that usage of interactive systems is. The objective is to provide, develop and exemplify how these models and concepts can be made use of in interactions design and to further sharpen them so that

more shades of use will be discernible for articulation, reflection, communication, discussion, critique, judgement and composition. The aim is, furthermore, to contribute to developing a language of interaction design that can be used throughout the entire design process from analysis, over design to assessment of impact.

1.4. Overview of the Thesis

Interaction design is a profession and research field that, within the use-oriented tradition, has the use of interactive systems as the object for design. It is young both as a profession and as a research field and there is consequently a certain disagreement and debate regarding theories, tools and expertise. The aim of this thesis is, as stated above, to contribute to the development of the field through empirical and reflective work that further refines models for thought and appropriate units of analysis that can be made use of when discerning shades and nuances of usage as a design object. The purpose of that is to facilitate designers', design students' and researchers' discussion, critique and judgment of the qualities of specific interaction design solutions.

Chapter 2 outlines the theoretical framework and concepts for reasoning about the use of interactive systems, and about the composition and judgement of design alternatives. Use is perceived as mediation and it is seen as having multiple aspects (instrumental, communicational, aesthetical, ethical and constructional). Specific design solutions can be seen from various perspectives disclosing different characters in use (e.g. the computer as a tool or a medium). Features and attributes of design alternatives are thought of in terms of design patterns and use qualities. The research problem is specified as what appropriate units of analysis are in interaction design and it starts out from the framework of use-oriented design and use as mediation to gather an empirical basis for a discussion of what interaction design can be in terms of *multiple aspects of use*, *characters, design patterns* and *use qualities.* The specific objective is to investigate how these models for thought can be utilized for understanding, articulating, and reflecting on shades and nuances in interaction design for sociable use.

The topic for Chapter 3 is the research method and the rationale behind it. Three cases of sociable use were investigated in a collective qualitative case study: professional use of computers in customer meetings at banks, educational use of computers in a design studio,

and leisure use of multimedia platforms in the home. The empirical work in the three settings included meeting all in all 49 informants during 41 observation and semi-structured interview sessions ranging from one to four hours, and 17 half-day workshops. The written up and transcribed field notes were analyzed, thematically concentrated, categorized, and hierarchically organized into use qualities, characters, and design patterns in interpretative iterations using the notion of multiple aspects of use within the framework of use as mediation. Three experimental prototypes were also designed within the case of leisure use of multimedia platforms in the home.

In Chapter 4, which is the first chapter of empirical nature, the settings of the three cases of sociable use are described, starting out with a review of the relevant literature and then describing the activities that take place in the settings.

Chapter 5 is the second empirical chapter and it describes the use of interactive systems in co-present sociable use is described in terms of the desirable use qualities participation, autonomy, extemporaneity, and politeness. These desirable use qualities make the three case settings similar. The chapter also outlines the use qualities that make the three setting different from each other. It finally describes the characters of interactive systems in sociable use (e.g. the computer as a tool or as a medium). The results show that the character may change swiftly in the middle of usage, which means that people are using the systems quite differently from one moment to the next. For example, at one moment other people may be in focus at which an interactive system is used as a resource. At another moment the information content may be in focus, while other people are peripheral, at which it is used as a mass medium.

Chapter 6 is the third empirical chapter, where themes from previous chapters are developed into design patterns for interactive systems in sociable use. The first pattern, REGULATING PROMINENCE, is an activity pattern, describing the activities of people in sociable situations. The second pattern, COMBINATIONS OF MOBILE AND STATIONARY DEVICES, is a artefact pattern, describing how to choose technological platforms. The third, fourth and fifth pattern, DROP CONNECTOR, GO CONNECTOR and SEND CONNECTOR, are user interface patterns describing how to allow users to seamlessly move information objects between devices in order to regulate prominence. A

multiple-device platform called LOCOMOTION is finally derived from the patterns as an example of how they can be realized.

Chapter 7 presents reflections on design patterns, characters and use qualities of interactive systems in sociable use, in the light of multiple aspects of use as mediation. This chapter moves the results beyond the specifically sociable use situations of the three cases, to usage of interactive systems in a more general sense. It is argued that thinking about what character to give to a system facilitates designers to deliberate how the system should behave and appear as a consistent whole. It is also argued that interaction design is to design the perspectives on the space for actions that one wants to provide users with, without hindering them from taking their own perspectives.

Descriptive and value-laden utterances and phrases from various stakeholders in a design project can be stated in the form desirable use qualities. Thinking in terms of *the use quality prism* and applying it to every identified quality will reveal its different aspects (instrumental, communicational, aesthetical, ethical and constructional). Furthermore, analysis of use and composition of design can meet where the motives of the use activity and the purposes of a component in a design solution meet, namely in the desirable use qualities. These qualities can then be expressed as design objectives that can be hierarchically ordered to show dependencies and make a clear statement of what a design project aims at. Use qualities can in addition function as forces in a design pattern, which means that traditional qualitative analysis into categories of use qualities, can work as empirical basis for patterns in CSCW and HCI.

Deliberation and consideration of the dynamic characters and use qualities of interactive systems is an essential skill for an interaction designer. Characters and qualities to design for will provide the users with a perspective on their space for actions, which they will modify and reconstruct in-situ through their activities.

Chapter 8 concludes the thesis and discusses consequences of the results for the practice, theory and learning of interaction design. The contributions of this thesis are grouped in three areas. Firstly, interaction design is thought of as design of mediation within a socio-cultural tradition. Secondly, the notions of multiple aspects of use and desirable use qualities are expanded on. Thirdly, the empirically grounded design patterns and desirable use qualities for sociable use of interac-

tive systems are discussed. Methodological issues such as the importance of theory in design research are finally discussed, before future research needs are addressed.

2. Theoretical Framework

As described in the first chapter, this thesis aims at specifying and providing appropriate units of analysis and models for thought, reflection and articulation in interaction design for sociable use. This chapter outlines concepts for reasoning about use and the composition and judgement of design alternatives, where use is perceived as mediation and as having multiple aspects. Design alternatives are presented from various perspectives disclosing different characters. Features and attributes of design alternatives are thought of in terms of design patterns and use qualities. The relation between use qualities and usability attributes and user experience attributes are also sorted out. At the end of the chapter, the research problem of this thesis is formulated.

The theoretical framework draws largely upon phenomenology (especially Heidegger (1974, 1981) and Merleau-Ponty (1962)) and socio-cultural theory (especially Vygotsky (1978) and Leontiev (1978)). These two traditions have also previously cross-fertilized each other in the area of human-computer interaction (e.g. Bødker, 1996).

2.1. Use as Mediation

We are engaged in the world before we are reflective. This is what Heidegger calls being-in-the-world.[1] It means that we are thrown into

1. As Heidegger tried to escape the dichotomies inherent in our language he invented a new terminology. For example, instead of 'human' or 'individual' he called the one who enquires after its own being 'Dasein.' Even though I try not to get caught in the dichotomies of subject-object and mind-body in Western thought, I will avoid using a language that is as difficult to understand as Heidegger's at times is. I will however use his terms when emphasizing that the framework of phenomenology is used.

a situation where we act and cannot avoid to act. It is the primarily unreflective state of active engagement directed towards the things that we care about as the world presents itself to us. Our practical artefacts are ready-to-hand for action disappearing into the background of our attention, and becoming transparent as we focus on the objects of care. (Winograd & Flores, 1986; Suchman, 1987; Ehn, 1988; Coyne, 1998)

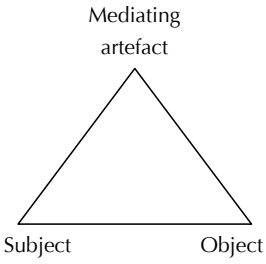

Figure 2.1: The basic triangle of mediation.

The use of an interactive system is in this thesis seen as engagement in the world by means of our practical artefacts. In other words, *mediated action* is here taken as the design object of interaction design. Mediation has, as shown in Figure 2.1, traditionally been depicted as a basic triangle of mediated activity (see, for example, Cole & Engeström (1993) or Kuutti (1996)). The figure consists of an acting subject, the mediational means (or mediating artefact), and the object, which action is directed at. It states that there are relations between the three constituents and that there is some outcome in terms of an affected object.

The Irreducible Tension between Agent and Means

The most common example to use when describing mediation is that of the blind man with the cane (utilized by Merleau-Ponty and Wittgenstein). The blind man perceives the world through the cane, a skill that has to be learned, actively probing his environment. As he walks down the street, he is not primarily aware of the cane, instead he is aware of the curb. Like all other perception, it is an active communion with the world. What he will experience is based on what he seeks and this means that his perception is governed by pre-objective intentionality given to him through his body and his previous experiences. When he has mastered the skill of using the cane it seizes to exist for him, becoming part of him and changing his bodily space by defining his space for actions (Arisaka, 1995). In Heidegger's terms we would say it is ready-to-hand and in the background. Where the man ends and the world begin becomes an analytical distinction and when we isolate either the agent or the artefact we need to remember that there is an irreducible tension between them (Wertsch, 1998).

The irreducible tension, but often analytically desirable distinction, between agent and mediating artefact is even more evident when considering intellectual artefacts rather than physical artefacts. An

example, provided by Wertsch (1998) of an intellectual artefact is multiplication. He asks us to consider the following multiplication problem:

```
  343
× 822
```

If you made the calculation it would give you the number 281,946 and if you could show me your calculations they would perhaps look something like this:

```
  343
× 822
  111
  686
 686
+2744
 281946
```

Who is doing the multiplication in this case? Is it the isolated agent or the agent together with an intellectual tool? Consider the same problem of multiplying 342 by 822, but without ordering the numbers in the array used above. Many of us would not be able to solve it. A few would be able to solve it by visualising the array in the head, but that would be cheating, since we are not allowed to use the array. It is not the isolated agent alone who solves the problem, but rather the agent *and* the intellectual, culturally developed, mastered and appropriated tool that together solve the problem. In the words of cognitive systems engineering one would say that the agent and the tool work together in ensemble as a joint system (Hollnagel & Cacciabue, 1999).

Breakdown

As mentioned above, the cane used by the blind man, is in the background of his activity of perceiving the world. It is ready-to-hand for action to the extent that it becomes transparent to the world. The blind man no longer perceives the cane but rather perceives the world through it. To him, he is not primarily using the cane; instead he is out for a walk. His space for action comes not from his understanding of the cane, but rather from his understanding of the activity of using the cane when he is out for a walk.

It is possible that our blind man would start thinking about his cane, for instance as a consequence of getting a new cane and reflecting on how it feels in comparison to the old. This detached reflection requires that the cane is unready-to-hand and instead it becomes present-at-hand, an object of study. The process of transformation from ready-to-hand to present-at-hand is called a breakdown or sometimes objectification or conceptualization.

When a breakdown occurs the qualities of the artefact, in this case the cane, are disclosed to the user. Before that, when it was ready-to-hand, it did not exist as an object, but rather as a mediating artefact which is an extension of the bodily space for action. As our being-in-the-world is disturbed by a breakdown, the fabric of our taken-for-granted everyday world is disclosed to us so that we can reflect on it and question it. Being able to make things present-at-hand are hence vital to a design process or any other process of change (Ehn, 1988).

Resources and Constraints

Our artefacts do not only enable us to engage in the world, but they also constrain us. The artefacts and the environment around us are structuring resources (Lave, 1988, 1991) in that they have structuring effects on our activities. They guide our perception by making some qualities of our world salient, while hiding other qualities of it, and they make some actions possible or obvious, while making other actions impossible or unobvious. For instance, the cane is structuring the blind man's lived world in a certain way, and an obvious act it provides is going tap, tap, tap with it. The array for doing multiplication structures our activity of calculating the numbers into easily performed operations. Another example is how irresistible it is for a child to run in a long corridor. The corridor structures the child's activity of moving and invites him or her to run rather than walk.

These structuring effects of our artefacts and environments do not only enable us and invite us to do things. They also inhibit us and constrain us. For example, the Roman numerical system constrains us from doing multiplication, which we easily can do with the Arabic numerical system (see Norman, 1993), and a traditional lecture hall inhibits group work while enabling lectures. In the case of the corridor that invites to running, it does not invite to meetings.

As we can see, the artefact do not only enable us to do things, it also constrain us. It is more to the point to say that an artefact *transforms* the action (Wertsch, 1998). It is not the same mediated activity to write a book with a pen, as it is to write a book with a word processor.

Burke's Pentad

Wertsch (1998) views mediated action as the irreducible tension between an agent doing something and the cultural tool (or mediational means) that is used. Burke's (1969) notion of the *pentad* of human actions and motives is a cornerstone of Wertsch's view on mediated action. He argues in the voice of Burke, that it is studied by identifying the action that is performed, inquiring what the scene of the action is (the context or the situation in which it occurs and its history), and finding out what person or role that is performing the action: who the agent is. After that, one is asking by what means the action is performed: what its agency is. Finally, one is putting 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 (action), who (agent), where (scene in time, place, and social setting), how (mediational means) and why (purpose of the action and motive of the agent). Bødker (1996) provides examples of how these questions can be used in the design of interactive systems. Making an analysis like this sounds all together very simple, but it is a deceptive simplicity. Stating and naming an agent or a scene does not make them real. We must question how we set the scene, identify the action and point out an agent. The purpose of an action is often complex or even contradictory and the interpretation of it is not simple. 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 one's mind as new interpretations and other ways of understanding arises.

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

The Sociality of Mediated Action

At this point, it is clear that the basic triangle of mediation, as depicted in Figure 2.1, is indeed a coarse simplification. Wertsch proposes that it should be put into Burke's pentad. Other alternatives do however exist. For example, Engeström has developed a framework for mediated activity based on Leontiev's activity theory (Leontiev, 1978) specialized for organisational studies of activity that besides from the three basic parts (subject, mediating artefact and object) also, as in Figure 2.2, include social rules, community and division of labour to cover the social aspects of mediated activity (Cole & Engeström, 1993, Kuutti, 1996).

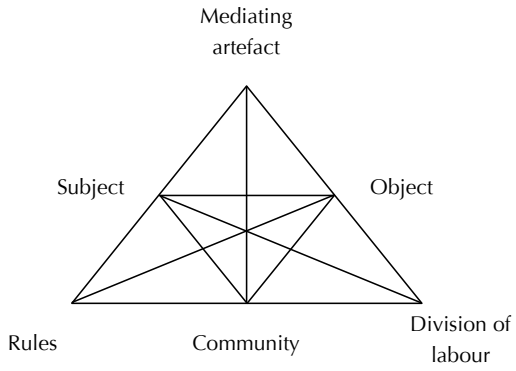

Figure 2.2: The activity triangle extended by Engeström.

Mediated action is certainly social to its nature, as activity theory suggests. A person who is actively engaged in the world by means of the artefacts at his or her disposal is, in a sense, never alone. There is a collectivity to mediated action. There is already solidarity in what Heidegger calls being-with, which is the human condition, into which we introduce the technologies that mediate our activities (Coyne, 1998). Practices are taken over from within the tradition of a community.

Communities of practice (Wenger, 1998) do not only provide the artefacts, but they also provide a disposition towards the world. A person's concernful dealings with the world are directed and pragmatically oriented towards the things that he or she cares about (Coyne, 1998.), but the way the mediating artefacts are designed provides the structuring resources in the form of, for example, strategies for highlighting important aspects, schemes for categorisation and ways of

representation (Goodwin, 1994). As already noted, an artefact highlights certain features of the object, which actions are directed at, while it conceals other features of it. The artefacts are resources and constraints for deciding what to care about and what to see in the world. Social norms and interactions are also part of the community of practice and they shape, and are shaped by the activities that take place in the community (Wenger, 1998). Artefacts are not the product of pure rationality, nor are they the product of whim. They have come into existence as part of the culture, history and institutions of the community. The collected experience and skill has been crystallized in the artefact (Bannon & Bødker, 1991; Kuutti, 1996). This means that replacing one cultural artefact for another will unavoidably create a new mediated action, qualitatively different from the previous one. In Wertsch's (1998, p. 43) 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.

This tension between actor and the mediational means is characterised by mastery as well as appropriation of using the means. The agent may have the know-how of using a mediational means, but may not have appropriated it; made it into his or her own. I may be very good at using a particular word processor, while not feeling at home with it. Both mastery and appropriation of mediational means are achieved by experience and participation in communities of practice.

Levels of Action

In activity theory, action is conceptualized as being on different levels: activity, action and operation (Leontiev, 1978). An activity takes place over some time and an object is transformed in a process rather than in a moment. The activity is thought of as driven by motives. Leontiev uses a rather restricted sense of the everyday meaning in the word 'motive'. He sees the motive as the object that initiates the activity. In the activity getting food the motive is hence food, which is couple to the need for energy, vitamins, minerals etc. It may also be coupled to

the desire of eating as a subjectively fulfilling activity. Leontiev hence sees the motive as a material or ideal object. This is why many writers in activity theory seem talk about the motive and the object as the same.

An activity can involve several smaller activities that can be described, for instance, as phases. Shorter-term activities can be described as consisting of chains and networks of both individual and collaborative actions that are tied together in the same activity by the overarching motive. The motive of the activity can be quite complex, but the goals of the actions that take place in the activity can often be readily articulated. The actions can, however, not be understood without relating them to the activity in which they take place.

The actions are driven by goals. In the case of getting food where the motive was food, an action could be to make a hunting tool. The goal is then the object of the hunting tool. Here we see that the goal of the action is not the same as the motive of the activity.

Actions in turn consist of almost sub-conscious and automated operations that are triggered by conditions in the situation. Operations are habituated routines used in response to the conditions of recurring situations.

Activities are thought of as dynamic. Development takes place on all levels so that new operations are formed as conscious actions are practiced, at which they can be used as parts of other actions. Operations unfold back to actions and new actions are being invented and experimented with. At the level of activity, motives and objects are being questioned and reformulated in longer-term developments trying to work through contradictions in the activities that take the form of clashes, breakdowns and problems. (Kuutti, 1996)

Bødker (1989, 1996) chooses to call the act of deliberately making an artefact present-at-hand a *focus shift*, and not a breakdown as described earlier in the chapter. In a focus shift normally sub-conscious operations are conceptualized and articulated as conscious actions, for example when a student explains to a teacher what he or she is doing.

Situated Action

A risk of more formal notations of human activity is that the object of study is forced into a framework, making the researcher insensitive to the richness of everyday life of real people (Walsham, 1995). The more

formal versions of activity theory run that risk (Svanæs, 2000). The structural representations of activities also run the risk of making the researcher conceive human mediated activity as something static and Kuutti (1996), among others, has emphasized that it is all but static. It is instead highly dynamic and fluid; plans and models that people have of how to perform an activity is merely orienting them and artefacts that at first are means for action can later on be the object of our activity. Purposeful human action is not primarily rationally planned. It is rather situated and social and in direct response to the physical and social environment (Suchman, 1987). Since activities are situated, the act of forcing them into a framework is an act of freezing the process. When the activity is described in the activity triangle or Burke's pentad it is a snapshot of the activity rather than the activity as it unfolds in situ.

Individual and Joint Action

Mediated action is not only an individual phenomenon, and it is not only a social phenomenon in the sense of it being cultural. It is also social and collective in the sense of being jointly performed by several actors in a coordinated effort. Examples of joint activities would include playing ice hockey, designing a fighter jet, or a having a meeting about the city plan.

Joint activities are performed by the joint actions that drive the activity. The joint actions are in turn made up of coordinated individual actions performed by participants in their roles. Clark (1996) provides a number of examples of joint activities and includes for instance planning a party, making business transactions, playing chess and playing in a string quartet. The individual actions of the participants are coordinated continuously. Joint activities have entries and exits, and can be ordered in sections and sub-sections according to their levels. As the activity proceeds the participants adds to their common ground and constantly change their current understanding of the state of their activity. In every joint action, the participants face a coordination problem, and in order to resolve it they make use of different coordination devices in the form of conventions, precedents, explicit agreements, or jointly salient events. Representations of the current activity like, for instance, the board in a chess game is a mediating means that functions as a coordination device. (Clark, 1996)

Some further issues on joint activities and their coordination in relation to the use of interactive systems are further elaborated on in Chapter 4.

2.2. Multiple Aspects of Use

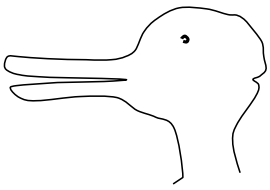

Figure 2.3: Wittgenstein's duck-rabbit.

Let us now turn from the use of interactive systems as mediation to the multitude of perspectives that can be applied to the phenomenon. Every perspective that is taken on the use of an artefact will disclose a number of different aspects and qualities of the systems-in-use. Wittgenstein (1953) discussed at some length, a figure that can be seen as either a duck or a rabbit. In one sense we see the same thing whether we are seeing a rabbit or a duck, but in another sense we see completely different aspects of the figure. I will argue that it works in an analogous way when we as designers, researchers or users look upon the usage of interactive systems. Depending on what we are looking for we will see completely different aspects of the system-in-use.

Taking one perspective will provide one image of an event, while taking another perspective will give another image of the same event. In relation to design, Nelson and Stolterman (2003) describe it as working with multiple modes of inquiry where the designer can make a choice of which "design palette" to use. The choice of the modes of inquiry leads to different design palettes and hence different design outcomes. On the notion of the correctness of a certain perspective Nelson and Stolterman write:

> Can [the designer] guarantee that that the choices made [of mode of inquiry] are the absolutely correct ones for the design in question? No. There is no way to discern what their choices might mean in the ultimate particular case of design. It will always be a choice that is at best based on *intention* and *will*. Most importantly, a designer must realize that all of these choices are *inevitable*. They cannot be avoided and therefore will be made whether the designer is aware he or she is making them, or not. A conscious approach is definitely preferable. (Nelson & Stolterman, 2003, p 105)

Multiple perspectives, traditions and modes of inquiry can hence help a designer form a design palette, from which design judgements will then be made.

The Pyramid of Things

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 as in Figure 2.4. The base of the pyramid consists of the most typically instrumental things like nuts and bolts, matches, and machines. In this base we can find all tools for work including office appliances. The instrumental function and utility dominates these objects, but they also have another trait in common. They can be reproduced almost infinitely without losing their value; they are impersonal and anonymous. The free painting or sculpture with purely aesthetic functions would constitute the top of the pyramid. These pieces are original, unique and personal objects that cannot be replaced. An instrumental thing from the bottom of the pyramid can always be aesthetisized by taking it out of its use. This is what happens to things in design magazines and at most 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 instrumental 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.

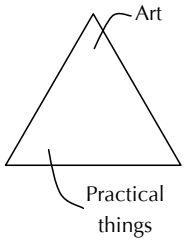

Figure 2.4: The pyramid of things.

In order for a designer or researcher of interaction design to assess the value of a particular design it is necessary to step back and view the whole use in its totality from different value perspectives, like in Hård af Segerstad's 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, to disclose the different aspects of the interactive system-in-use. This is an essential component in the professional competence of systems development in general and interaction design in particular (see Nygaard & Sørgaard, 1987).

A Multitude of Multiple Aspects Models

Several multiple aspects models of the use of interactive systems 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 Aristotelian ideas in 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 interactive systems, Ehn and Löwgren (1997), and Ehn, Meggerle, Steen and Svedemar (1997) present a model consisting of three aspects. 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.

Howard (1999, 2002a, 2002b) presents examples of how Ehn and Löwgren's model can be applied. Elaborating further, Löwgren and Stolterman (1998) use four aspects. 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 denotes the experience of the system.

Dahlbom and Mathiassen (1995) have another model, which however is similar. Their model contains three aspects: 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 construction as an aspect that has to be taken into account in the design. Dahlbom and Mathiassen do not; instead they prefer to regard it as a part of the functional aspects of the system.

Dahlbom and Mathiassen view use 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 an interactive system even though it sometimes is difficult to quantify, for example, the goodness of a chair for sitting. The social use quality (symbolism) of an interactive system is not measurable; it's meaningless to say that a certain system is twice as appropriate as another. To Paulson and Paulson, 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. 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 usage have one thing in common; they highlight that there are multiple aspects of use. When analysing a use situation it is essential to adopt a pluralistic view on what that goes on there, incorporating the beautiful, the appropriate, the practical and the doable.

The different models presented above are overlapping and complementary to each other. I will therefore try to offer a synthesis of them in terms of instrumental aspects, communicational aspects and aesthetic aspects of using an interactive system. Constructional aspects and ethical aspects that also are part of the synthesized model are very salient during the design and construction of an interactive system, but they occasionally disclose themselves in usage as well.

Instrumental Aspects of Use

The instrumental aspects include the usage for utilitarian purposes. There are specifiable goals to be met and it is possible to assess or even measure how well these goals are met. To give an example of a word processor: The instrumental goal might be to write a book, and the instrumental value of using the system is how effective and efficient, or easy a user can meet that goal.

Paulsson and Paulsson view instrumental aspects (or practical, as they call it) as generally applicable, which I do not. The instrumental value of using an interactive 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 at the very moment of using it.

It is, however, possible to think about all qualities of using an artefact in terms of instrumentality and utility. One can for instance talk about the utility of fun, or the utility of relaxation. Falling back on the instrumental aspects of use alone will in spite of this provide an impoverished view on our life-world, at which other aspects call for attention.

Communicational Aspects of Use

The communicational aspects are the ways in which an interactive system is used in relation to other people. This is an aspect of usage with two different faces. The first face shows itself when an interactive 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 other's meaning, and that the action or utterance of an individual is understood or interpreted "correctly" by another. An interactive system may facilitate this intersubjectivity by functioning as a shared representation or an effective channel or arena for communication.

The other face of the communicational aspects 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 as part of a community of practice. It also has conventional or cultural meanings ascribed to it as a symbol and it is used and interpreted according to the traditions and institutions within a community. This also means that it is associated with authority, power and other terms like appropriateness (it may, for instance, not be appropriate to place a kitchen chair in the dining room).

Aesthetical Aspects of Use

Aesthetical aspects appear as Paulsson and Paulsson 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 every shift of tone in a musical piece. It is directed towards experiential goals of affect and meaningful whole. The aesthetic use stands in an interesting relationship to the communicational and 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 within an interpretative community. The beauty of an experience is however not only social and subjective, it also carries objective traits like the ones of a pure gestalt, and of harmonies of contrasts, nuances, grades and shades. 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. Shusterman (1999) argues that aesthetic qualities reside in the dynamic and developing experiential activity through which they are created and perceived. In his eyes, the idea of aesthetic use (of art at least) is to provide beauty and pleasure. I do, however, not agree. A fragmented gestalt with disharmony may be ugly and give uneasy feelings, but still be in aesthetic use.

Paulsson and Paulsson view aesthetic aspects as being disclosed in a moment of contemplation, in an unreadiness-to-hand. Yet there is also immediacy to the experience of it. Especially in the unconscious feeling that the use of an interactive system creates as part of the routine experience as it is ready-to-hand: its pace of interaction and the mood of use 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 an interactive system that the aesthetic entirety is realised.

The aesthetic qualities present themselves to a socio-historically situated person in an immediate experience that preferably stands out from routine experience in a memorable and rewarding whole of unity, affect, and value which is directly fulfilling (Shusterman, 1999). It is also the contemplation upon that experience, in an act of making sense of the disclosed object that is present-at-hand. One should not believe that there is such a thing as pure experience without assumptions and interpretation. Even when the experience is immediate and vivid the socio-historically dependent assumptions guide perception. This view of the aesthetics of interaction design is highly influenced by pragmatist and phenomenological philosophers like Dewey, Heidegger and Gadamer.

Ethical Aspects of Use

Ethical aspects, such as democracy at work, have for a long 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 to that tradition. It is, in my view, 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. Every designer should at times take a step back and reflect on his or her values, and the overall systemic consequences of the particular design project. Furthermore, the design of an interactive system might have an impact in a certain culture that it would not have in another due to the prevalent norm 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. They provided the resources for action but did not perform the actions. 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, 1997) and Stolterman and Nelson (2000), or Nelson and Stolterman (2003) for a further elaboration on these matters.

Constructional Aspects of Use

Constructional aspects 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 is a very agile material, 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 information technology different from other design materials. When designing a tool like a photo editor, interaction designers get to design the material too. We 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 material; where do the one end and the other begin? This is a phenomenon that usually arises when the system to be designed is highly complex and dynamic (McCullough, 1998). This is seldom the case in for example industrial design, and further research on information technology as design material would indeed be interesting reading.

The Dynamic Nature of the Interactive Material

There is one potential problem with multiple aspects models concerning the material of interaction design. Their origin is in architecture and they do not carry the dynamic properties inherent in the material of information technology. Löwgren and Stolterman (1998) recognize this when they talk about forming the "dynamic gestalt" of the interactive system. 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 and 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 truer for interactive systems than it is for more static artefacts. Holmlid (1997) has criticised Ehn and Löwgren (1997) on this account, pointing out that their aspects 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.)

When designing in software, rather than in brick and stone, one must work with the flow of interactive behaviour, which means that time, tempo, and kinaesthetic bodily experience becomes critical design factors (Redström, 2001; Svanæs, 2000). This is the same criticism directed to the frameworks of the activity triangle and Burke's pentad, and it must be dealt with in a similar fashion: The seemingly rigid models should be treated as simple and convenient representations, but the development and dynamics of human activity must always be attended to and we cannot bring the world to a standstill while we analyse (Kuutti, 1996; Bødker, 1996).

2.3. Perspectives on the System-in-Use

This chapter has so far covered the notion of usage of interactive systems as mediation, as well as different aspects of interactive systems-in-use. The chapter now takes a turn and narrows down on the role and character of interactive system, which is in use. Let us return to the analogy of Wittgenstein's duck-rabbit. Not only the usage of interactive artefacts can be approached from different perspectives thus revealing different aspects. In an act of perceiving as, the interactive system-to-be-designed can also be approached from different perspectives and hence reveal the system as having a multitude of characters.

The notion of design perspectives was brought into the light when the Scandinavian tradition to information systems development, also known as participatory design, entered the international research arena (Ehn, 1988; Greenbaum & Kyng, 1991). The idea is that an

interactive system is designed with a certain perspective on what the computer is. People in the Scandinavian tradition entered the design of interactive systems with the perspective of that they were designing a tool for experienced and skilled workers. This stands in contrast to viewing the computer as a medium, a dialogue partner, a system or a machine. The reasoning here builds on Kammersgaard's (1988) four perspectives on HCI: the tool, the media, the dialogue partner and the system. It also draws upon Ehn's (1988) and Bødker's (1989, 1996; Bødker, Nielsen & Petersen, 2000) use of the perspectives. The perspectives are viewpoints that a designer, a user, or a researcher may apply to a system-in-use in order to highlight certain aspects of it. Each application or component can, at any given point in time, be seen from any of the perspectives. Bødker (1996, p. 154) writes:

> Almost no real-life computer applications can be understood in terms of only one of these perspectives. Analytically they are applied by tracing and characterizing the web of different activities that takes place around a computer application and in particular, contradictions among the different uses.

The Tool Perspective

Ehn (1988) had the focus of the computer as it was or could be used by skilled workers. In this perspective it is a tool to perform a task. The tool perspective takes the labour process of workers as a starting point rather than the organisational system and its data or information flow, which has been common in information systems development. The intention is not to automate workers' skill but to build computer-based tools by means of which craftsmen can apply and develop the skills within their community of practice.

When a user is shaping a material by means of a tool the material can be regarded to "speak back" to the user (Bødker, 1996; McCullough, 1998). Given this perspective there must accordingly be a material to which the user can apply the tool, in order to produce a result (see the previous section of The Dynamic Nature of the Interactive Material). The relation between artefact and user is highly asymmetrical and control is an important quality. It is preferred if the tool can become almost invisible to the user so that he or she only sees the activity, as described earlier under the heading Use as Mediation. For

example, a carpenter does not use a hammer, but is rather hammering. The hammer is invisible until there is some kind of breakdown in the activity, for instance if the carpenter hits a finger or if the shaft breaks. The artefact itself then comes into focus and moves from being the mediating artefact ready-to-hand into being the object present-at-hand. Transparency of the interface then becomes important so that the user can understand what went wrong, recover from the error, and return to the activity of production. Many production-oriented computer applications can today be seen as tools.

Hallnäs and Redström (2002) argue against the tool perspective, which is common in use-oriented design tradition, when they make a case for design for presence rather than design for use. They think that the tool perspective and the conception of use highlight the purposeful instrumental aspects to a too large degree at the expense of the aesthetic aspects of being-in-the-world with the computer-based artefacts.

The Media Perspective

In the media perspective, the computer is a medium for communication; it is a vehicle for signs. In Bødker's (1996, p. 154) words: "the media perspective emphasizes the human engagement with other human beings through the computer application." This perspective on the computer has spread enormously with the growth of the Internet. An application with the character of a medium promotes and allows human-human communication, either in the form of one-to-one communication such as email or in the form of one-to-many as in online newspapers. Another distinction relevant to media is whether they are synchronous or asynchronous.

The difference between a tool and a medium is that the object of the activity is not a material but rather one or several other people. The media perspective implies that there are a number of roles involved. There are at least producers and consumers; there is also some media content as well as a form to that content. The perspective highlights that "readers" of the media are involved in a sense-making process when interpreting the content. From a media perspective it also becomes natural to discuss narratives of interactive systems as well as, semiotics, persuasion, artistic expression, genres, interactive play and hence also games (e.g. Laurel, 1993; Andersen, 1997; Walldius, 2001;

Fogg, 2003; Lundberg, Arvola & Holmlid, 2003; Salen & Zimmerman, 2004).

The media perspective emphasizes use qualities like expression of ideas, meaning and understanding, intersubjectivity, fantasy, fiction, playfulness, fun, and pleasurable engagement.

The Dialogue Perspective

The dialogue perspective treats the computer as an agent to have a dialogue with. It is preferably conducted on the user's terms and human-human communicative behaviour is therefore used as a benchmark (Qvarfordt, 2003). Written and spoken natural language is the primary form of interaction, and feedback that allows meta-communication is important. Quite often the dialogue partner can be represented as an agent of some kind. The actions of a user are directed towards the objectified interactive system by means of natural language. The application then performs the actions that the user has requested. The dialogue perspective does not expect the user to be in total control over the interactive system. It has instead some degree of autonomy and intelligence so that it can be not only interactive but also pro-active and anticipatory.

The System Perspective

The system perspective takes the view of the human and the computer as components in a functional system, and it is common in the tradition of systems engineering. The systems perspective is the birds-eye control perspective (Bødker, 1996), where both users and computers are part of a larger system (for example a business or a traffic system) that tries to accomplish something in a controlled manner. The acting subject is instead the one who uses the socio-technical system as an instrument without directly contributing to the production of the outcome. Standardized tasks can be allocated between human and human, as well between human and computer. The starting points are what the system is supposed to be able to do, and the flow of outcomes and information in activity networks is the object of study and design.

The Machine Perspective

People entering the area of human-computer interaction from the tradition of ergonomics often view the computer as a complex machine where the human is seen as an operator.[3]

Viewing the computer as a machine suggests its complexity and its autonomy. It suggests that we do not have it completely under control, as in the tool perspective. The operator is subject to the structure of the machine and has to adapt to it while trying to control it. In contrast to the tool perspective the machine perspective does not hide the values built into it. When the smart bomb is viewed as *merely* a tool the design of it is free of value and moral considerations. It is viewed as under complete control and it can be put to use with great precision. When it is viewed as a machine the extreme complexity of it, control of its autonomy, as well as its unforeseeable consequences is highlighted. (Janik, 1980; in Ehn, 1988)

Characters of Interactive Systems in Use

When an interactive system is designed from a certain design perspective it is reasonable to assume that it gets a character in its usage that correspond to the perspective. Ehn (1988, p. 396) writes:

> In short: computer artifacts are what they are used for, but they can also be designed as the reminders we want them to be.

Ehn is expressing that the character of interactive systems is determined in use, but that they can be designed to forefront certain characters, or remind us of certain characters that are familiar to us.

Janlert & Stolterman (1997) have defined a character of a thing as a coherent set of specific qualities. They argue that designing a computer system with consistent character, regarding behaviour and appearance, provides support for anticipation, interpretation, and interaction. When an interactive system changes its behaviour temporarily it can be said to change mood.

This definition is quite similar to the one Laurel (1993) uses in her description of computers as theatre. She defines character as:

> …bundles of traits, predispositions, and choices that, when taken together, form coherent entities. Those entities are the agents of the action represented in the plot. (Laurel, 1993, p. 60)

3. I am indebted to Jonas Lundberg for pointing out to me the existence of this design perspective, during one of our long discussions on the matter.

She furthermore continues by defining the criteria for a good character:

> Using the Aristotelian definition of "virtue," good characters are those who successfully fulfil their function—that is, those who successfully formulate thought into action. Good characters *do* (action) what they *intend* to do (thought). They also do what their creator intends them to do in the context of the whole action. The second criterion is that characters be "appropriate" to the action that they perform; that is, that there is a good match between a character's traits and what they do. The third criterion is the idea that characters be "like" reality in the sense that there are causal connections between thoughts, traits, and actions. This criterion is closely related to dramatic probability. The fourth criterion is that characters be "consistent" throughout the whole action; that is that a character's traits should not change arbitrarily. (Laurel, 1993, p. 62)

It is quite straightforward to apply Laurels definitions from the realm of drama to computer-based agents, but when the character is not a dialogue partner it needs to be somewhat reformulated to make sense. Based on Laurels definitions as well as Janlert and Stolterman I take the character of interactive systems in use to be a relatively stable set of qualities of the actions that the system is designed to mediate. When taken together they form a coherent entity. When the character works, it fulfils its technical functionality in action, it has qualities that match the actions it mediates, and it also has logical connections between its technical functionality, its qualities and the actions that it mediates. Finally, its qualities do not change arbitrarily, but when they change momentarily for some reason it can be said to change mood.

Löwgren and Stolterman (1998) elaborate Kammersgaard's and Ehn's ideas about perspectives on human-computer interaction, by coining the concept of 'handlingskaraktär', which has been called 'interaction character' in English (Arvola, 2003a, 2003b; Qvarfordt, 2003). The list of characters that Löwgren and Stolterman suggests include the corresponding characters of the design perspectives: the tool, the dialogue partner, the medium, and the system component. They have not included the machine, but inspired by Laurel (1993) they have instead included *the arena*: a computer-generated stage where

actors are represented by avatars and act in relation to other actors. Immersion is important for the arena and a rich set of ways to interact with each other is sought. The arena can be described as a stage for social action, where the avatars are like puppets to the users, and they may have varying degrees of autonomy.

This list of characters is not seen as exclusive, but rather provides a starting point for discussions about the characters that interactive systems may have in their usage.

2.4. Features and Attributes of Interactive Systems-in-Use

The character of an interactive system in use was described as a relatively stable set of qualities of the actions that the system is designed to mediate. At this point it must be clarified what is meant by 'qualities' in the sense it is used in this thesis. Once more we return to Wittgenstein's duck-rabbit for a moment. Given that you see the figure as a duck and I want to show to you that it also is a rabbit, I will probably start pointing out some features of it, for instance showing you that the long pointy things also can be the ears of a rabbit and not only as a duck bill (Kivy, 1968). In order to show to you that the design alternative for a word processor that we are working on is not only a tool but also a medium, I need to point out its media-like qualities to you by refereeing to some of its features and attributes.

Pointing out features and attributes of interaction design alternatives is, however, not a straightforward issue. I will describe the concept of 'design patterns' as an approach to highlight features of design solutions that work and I will also describe 'use qualities' as an attempt to capture the attributes of interactive systems-in-use.

Design Patterns

During the seventies Alexander and his team (Alexander et al., 1977; Alexander, 1979) developed the concept of 'design patterns' within the field of architecture. It was a reaction against the kind of buildings that had been built within the modernist tradition, and he and his team felt that many of the immeasurable qualities of architecture had been lost. The patterns that his team made, strive at resolving conflicting forces,

wants, needs, and fears that exist in a specific situation in or around the usage of a building.

In order to characterize desirable features and attributes of design alternatives, every pattern describes a recurring problem, its context, the forces that are at play in the situation, and a solution to the problem. The feature that solves the problem is written in a generic but concrete way, so it can be designed in an infinite number of ways, while still being readily identifiable. Anyone should be able to see if a design solution has a particular feature or not. In a well-written pattern every reader should also readily recognize the problem. A pattern can be seen as a working hypothesis; each pattern represents the current understanding of what the best arrangement is for solving a particular problem. For this reason, it is important that the pattern is clear, sharable, and debatable.

Saunders (2002) has reviewed Alexander's work on design patterns and he notes that the research community in architecture, to a large degree, has ignored Alexander's work. Largely because it does not fit into the post-structural thinking that has dominated the architectural arena since the late 1970's. The patterns have been seen as expressions of utopianism, essentialism and environmental determinism, typical to structuralist thought. In addition, when reading the patterns it is not clear what empirical support that Alexander has for some patterns; evidence of critical thinking and careful research is lacking. The patterns describe an ideal well-lived life: "slow, relaxed, sociable, pleasure-seeking, affectionate, spontaneous, healthy, communal, cross-generational, sensually gratifying and full of leisure time for mingling and for solitude" (Saunders, 2002, p. 3).

The values that are embedded in Alexander's patterns are treated as universal and absolute, and are not subject to reflective thought. However, design patterns are not to be read as recipes, or treated as a Bible. They should rather be seen as means for fleshing out the social and experiential reasons for certain design solutions. Patterns are reminders of things to consider, and they articulate implicit knowledge that designers know or may feel. Sounders describes Alexander's book A Pattern Language as "imaginative, lively, spontaneous, and abundant, overflowing with quickly sketched, informed intuitions. (p. 6)" The focus of the patterns are on particular daily experiences, and they attempt at finding solutions that support seemingly contradictory

needs of the users. Saunders concludes that patterns should not be read as dogmas, but rather as imaginative and debatable descriptions of insights about how to solve potentially contradictory needs.

Within human-computer interaction design a number of different formats for writing patterns have been suggested (e.g. Granlund & Lafrenière, 1999; Tidwell; 1999, 2004; Erickson, 2000; van Welie & van der Veer, 2003; van Welie, 2004), but they are seldom as vibrant, alive, and concrete as Alexander's original style of writing. Martin et al. (2001, 2002) advocate a descriptive form of patterns. They include vignettes that are real examples from their own and other's fieldwork in order to contextualize the patterns. They do, however, not provide the concrete solutions to concrete problems that interaction designers seek for, but they do certainly avoid the problem of patterns that Saunders pointed out; they are grounded in empirical evidence and critical thinking.

Use Qualities

A recent approach to characterizing features and attributes of design alternatives is 'use quality' (or quality-in-use). Based on the work by Ehn (1998), Ehn and Löwgren (1997), Löwgren & Stolterman (1998), Löwgren (2001), Holmlid (2002), and Howard (2002), I use the concept of 'use qualities' to denote the attributes of an interactive system-in-use (in the activity which the system mediates). The presence of desirable use qualities is what provides good use quality products and services. The ideal of designing for use quality can be traced back to Scandinavian humane Modernism in architecture and product design (Paulsson & Paulsson, 1957; Hård af Segerstad, 1957), with the perhaps best examples in the work of Alvar Aalto and Bruno Mathsson.

An interactive system that mediates the users' actions can be said to have many different qualities, or properties, in its usage. Some of the qualities are objective and others are not. Some are social and yet other qualities are subjective. Another aspect of use qualities of an artefact is their level of abstraction. They can be at a high level, functioning almost as dimensions of use. Examples include, the Space of Action that is set up by the system; the Changeability in terms of freedom to change the form, structure, or functionality of the system; and the Character of the interactive system in use, in terms of the set of

qualities of the actions the system is designed to mediate (e.g. the tool or the medium).

Other use qualities are more specific descriptions of how the system is, or how it should be (desirable use qualities). These specific use qualities can be expressed in the form of adverbs, adjectives or descriptively used nouns like 'effectiveness', 'elegance' or 'integration. All of these statements about how an interactive system is or should be in its use can be utilized for specifying and assessing design solutions. Howard (2002a, 2002b) argues that abstract non-quantified objectives help in retaining the focus on overall aspects of use qualities, before details cloud the picture. Lidman et al. (2002) also utilize such high-level design objectives.

Use qualities are multi-faceted and have all the different aspects described earlier; it is a matter of "perceiving as." Every action or even the entire activity of using a system has instrumental, communicational, aesthetic, constructional and ethical aspects. Some actions are more easily described as being instrumental, communicational or aesthetic, while other actions are more complex and can be described in terms of any of the aspects. Therefore, when a user, designer, or other stakeholder argue that the system ought to be, for example, 'reliable', its Reliability should be assessed in terms of its instrumental, communicational, aesthetical, constructional and ethical aspects. Other aspects such as affective, political can also be brought fourth if one wish to bracket the usage in a different way (see, for example, Holmlid (2002)).

Judgment of Use Qualities

When use qualities are used in a prescriptive rather than descriptive fashion, it becomes noticeable that some use quality criteria come into conflict with each other. Not all can be upheld at once. This means that there are tensions between desirable use qualities. These tensions surface in use as what Heidegger has called not-yet (Coyne, 1998). Not-yet occurs when we have an expectation on a particular situation that is not met. This will lead to a violation of expectations and hence produce the not-yet in the form of anticipation and desires, or a sense of unease, anxiety or incompleteness.

If the conflicting use qualities cannot be resolved in design, a designer or a user will have to make a choice. An act of justifiable valua-

tion must be made to discriminate the relative importance of the use qualities. Which is the most important? This valuation is, however, not an expression of relativism. It is rather an expression of pluralism and most especially of self-consciousness and reflective judgement. As Saunders (2001, p. 2) writes:

> It is absurd to argue about preferences; it is absurd not to argue about judgements.

Use Qualities and Usability Attributes

The use quality-approach is related to, and breaks with, the tradition in usability engineering of setting design goals based on usability attributes.

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 to design for during the early eighties. The attributes 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. LEAF stands for Learnability, Effectiveness, Attitude and Flexibility. The four attributes are used for setting usability goals, that is, design objectives for usability 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 of characterizing the attributes of interactive systems, is that designers approach the situation of use trying to learn what the attribute, e.g. effectiveness, mean for the particular product, task, user and context of use. From that understanding the designers create specific usability goals and objective measures that can be used to decide whether the attribute is obtained or not.

The main industry standard of usability today, is the ISO 9241-11(1998), which defines usability as: "the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments". There are close similarities between the ISO standard above and the values of for example Brook's LEAF. 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 attributes as the LEAF and REAL models but without the catchy mnemonic. Preece, Rogers, and Sharp (2002) add the usability attributes safety, utility, and memorability to a growing list of important attributes to consider in the composition of an interaction design solution.

Use Qualities, User Experience Attributes and Contextual Usability

Another approach to characterizing attributes of design alternatives is in terms of user experience attributes. This can be seen as a direct expansion of the notion of usability attributes, but instead of objectively measurable attributes the focus is on subjective attributes.

In the late eighties, the user experience view on usability (also known as subjective usability) appeared and it eventually developed into contextual design as contrived by Beyer and Holtzblatt (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. 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.

In order to handle that within the tradition of writing usability goals based on attributes to design for, Preece, Rogers and Sharp (2002) suggest that one should add user experience goals. Their list of attributes to consider, besides from traditional usability attributes, includes satisfaction, enjoyment, fun, entertainment, helpfulness, motivation, aesthetical pleasure, support for creativity, reward, and emotional fulfilment. It is clear that the sheer number of objectives for interaction design this leaves the designer with is quite difficult to manage.

The assumption behind the use quality-approach is that not all of the attributes for good interaction design introduced over the years are equally relevant for every system, and to meet them all in one design

solution is regarded as most unlikely. Use quality, based on the models of multiple aspects of interactive systems-in-use, described earlier in the chapter, can manage the diversifying trend for advanced contextual usability. The basic idea is to take a step back and ask what makes a certain system good to use from several different value perspectives, and from the perspectives of different stakeholders.

2.5. Thesis Problem

The aim of this thesis is to specify and provide appropriate units of analysis and models for thought, reflection and articulation in interaction design for sociable use. This chapter has described a number of potentially useful concepts for that: use as mediation, multiple aspects of use, perspectives on systems-in-use and their corresponding characters, design patterns and finally the notion of use qualities. The problem that this thesis addresses is how to make use of these concepts in the process of interaction design.

We make judgements about the use of products around us all the time, and I wish to investigate how the aforementioned theoretical concepts can be utilized as we assess the use of interactive systems. If these concepts can be turned into models for thought, reflection and articulation, they can potentially open up for questioning, refinement and change of the criteria employed, and even more importantly, the criteria not employed. A fairly wide knowledge interest of this thesis is hence to broaden our understanding of the characteristics that interactive systems display in use, as well as putting that understanding in a form that is applicable in interaction design research, education and practice.

Doing interaction design is not a walk in the park. Moving from analysis of use to composition of early design alternatives is not easy. Previous research has, with a cross-fertilization of phenomenology and socio-cultural theory, given interaction design practitioners and researchers some concepts for analysis of use as well as composition of design alternatives. Among the variety concepts for analysing use are the notion of mediation, Burke's pentad, the extended activity triangle, and the multiple aspects of use. Concepts for reflecting on the composition of design alternatives include the range of design perspectives that the design team can take in order to achieve a certain character of the interactive system-to-be-designed, as well as the notion of design

patterns. The concept of use qualities is a means for articulating and making judgements of the qualities that a system has or should have in its usage.

It is not straightforward how to apply these analytical constructs, stemming largely from social theory, when doing interaction design. This is also the problem that this thesis addresses, but it will not focus on all the aspects of all concepts covered in this chapter. Instead it focuses on sociable use.

Focusing on Sociable Use

There is a gap in previous research on the aspects, qualities and characters of interactive systems-in-use. Studies utilizing these concepts have not paid any real attention to a quite common situation of use, namely sociable situations: situations where several people are co-present, face-to-face and engaged in joint activities. Previous studies have often looked at individual's use of personal computers connected to a network. The interaction design community is therefore likely to learn more from investigations of aspects, characters and qualities in sociable use rather than individual use. This thesis focuses accordingly on such sociable situations of use.

Studies of use of interactive systems as mediation have looked at such situations, especially within the area of computer-supported co-operative work (CSCW). That research will be presented in more detail in Chapter 4. The notion of design patterns has also been used within that research.

Problem Formulation

This thesis will address the problem of what appropriate units of analysis are in interaction design and it starts out from the framework of use-oriented design and use as mediation to gather an empirical basis for a discussion of what interaction design is and can be in terms of *multiple aspects of use*, *characters, design patterns* and *use qualities.* The specific objective is to investigate how these models for thought can be utilized for understanding, articulating, and reflecting on shades and nuances in interaction design for sociable use.

The following chapters of this thesis will describe the studies that have been performed and their rationale. It will describe interactive systems in sociable use in terms of use as mediation, multiple aspects of

use, characters and use qualities. In the last two chapter of the thesis the concepts will be further discussed, elaborated and refined.

2.6. In Summary

This chapter has outlined concepts for reasoning about use and the composition and judgement of design alternatives.

The use of an interactive system is in this thesis seen as engagement in the world by means of our practical artefacts. Mediation was depicted as a basic triangle of mediated activity where a subject acts by means of a mediating artefact, directed at an object that the subject wishes to affect. The artefact is ready-to-hand for action to the extent that it becomes transparent to the world, but when the subject (the user) reflects on the artefact it becomes present-at-hand, an object of study. The process of transformation from ready-to-hand to present-at-hand is called a breakdown. The artefacts structure our world to us and they both enable and constrain us. Mediated action is also social to its nature in that it always takes place in socio-historical context for a purpose, which often is situationally motivated and a consequence of the situation at hand. When describing mediated action one must be attentive on what level the description is: activity, action or operation. Another distinction to be made is between joint and individual action. The use of interactive systems was finally described in terms of its instrumental, communicational, aesthetical, ethical and constructional aspects.

This chapter also described how interactive systems could be seen from various perspectives disclosing different characters: the tool, the medium, the dialogue partner, the system, the machine, and finally the arena.

Features and attributes of interactive systems were described in terms of design patterns and use qualities. A pattern is a problem-solution pair where the solution is a composition of features that solves a recurring problem that consists of potentially conflicting forces. Use qualities are attributes of an interactive system-in-use. They can be used both descriptively depicting how the use of a system is, or they can be used prescriptively depicting desirable qualities in the form of objectives to design for. The relations between use qualities and usability attributes and user experience attributes were also sorted out.

At the end of the chapter, the research problem of this thesis was formulated: what appropriate units of analysis are in interaction design starting out from the framework of use-oriented design and use as mediation to gather an empirical basis for a discussion of what interaction design can be in terms of *multiple aspects of use*, *characters*, *design patterns* and *use qualities*. The specific objective is to investigate how these models for thought can be utilized for understanding, articulating, and reflecting on shades and nuances in interaction design for sociable use.

Since most research into qualities and characters of interactive systems-in-use has focused on PCs connected to a network, this thesis focuses on sociable situations of use where people are co-present, face-to-face and engaged in joint activities.

The next chapter presents the method for going about addressing units of analysis and models for thought that can reveal variations in shades of sociable use in interaction design.

3. Method

In this chapter, the research method and the rationale for it are elaborated. Three cases were investigated in a collective qualitative case study: professional computer use during consultation at the bank, educational computer use in studio work, and leisure use of multimedia platforms in domestic environments. The empirical work in these settings includes meeting all in all 49 participants during 41 observation and semi-structured interview sessions ranging from one to four hours, and 17 half-day workshops. The written up and transcribed field notes were analyzed, thematically concentrated, categorized, and hierarchically organized into use qualities, characters of the systems-in-use and design patterns. Three prototypes were built within the case of multimedia platforms in the home to elaborate the qualities, characters and patterns in interpretative iterations.

3.1. Case Studies

The research problem was stated as what appropriate units of analysis are in interaction design for sociable use, starting out from the concepts of *multiple aspects of use*, *characters*, *design patterns* and *use qualities*. When considering that problem an empirical foundation is needed for reflection and discussion. The problem is approached by putting the

applicability of the concepts to test within several case studies. How to make best use of them is then reflected upon continuously as the empirical material is being gathered and interpreted with focus on what kinds of issues the different models for thought disclose in the cases. Given that some of the concepts have not been applied within the context of sociable use it was early on decided to focus the effort on such situations of use. The research approach is hence a collective qualitative case study.

The Choice of Cases

Collective case studies are instrumental studies that are extended over several cases. They are instrumental in that they provide insight into an issue or refinement to theory, rather than being driven by intrinsic interest in the particular case (Stake, 1994). The cases included in this thesis can be read with interest in the case itself but, they were conducted with an instrumental knowledge interest. They were chosen based on the perceived opportunity to learn.

The first that came along, as an opportunity, was the use of multimedia platforms in domestic environments, due to our close cooperation with Nokia Multimedia Terminals at that time. The importance of the sociable situation when using interactive systems in the living room was obvious and the case was partly chosen since little previous research had been made in that area at that time.

At the same time, another case presented itself as an opportunity to learn. It was the use of computers in customer meetings at bank offices. That sociable situation was different from the home in that it was more formal and professional. The relations between the people involved in the sociable situations were quite different from the case of multimedia platforms and therefore that case was chosen.

A couple of years later I wanted to create a contrast case that would be a little like both of the other cases. The choice fell on an educational setting, namely the interaction design studio at Linköping University. It was similar to the home situation in that the people involved knew each other well and had a quite informal relationship. It was, however, also similar to the bank situation in that they performed a task. In contrast to the bank situation an important feature of the situation was that it was all right to make mistakes. In fact those are seen as learning opportunities, and there are no major consequences

of mistakes. This third case was chosen to provide variety in the collection of cases.

Qualitative Case Studies

It was stated above that the collective case study of this thesis is qualitative. This means that it is concerned with questions of what there is, its kinds and its qualities. If the knowledge interest would be about how much something is, how large it is, its quantity, a quantitative approach would have been taken.

A qualitative approach is built on interpretation and the case studies included in this thesis can be called interpretative case studies (Walsham, 1995). Research is interpretative when the understanding of human sense making is gained through the study of social constructions (e.g. language, shared meanings, consciousness, artefacts etc.) as a situation emerges. Much of my view on interpretative research is built on my reading of Klein and Myers (1999) as well as Walsham (1995), Kvale (1997) and Ely (1993).

At the heart of every interpretative research practice is the hermeneutical 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. The parts and their relations must be understood in relation to the whole.

When discussing parts and wholes 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. Since one wants to say something about the particular instance 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 takes place in a cooperative process between researcher and participants, 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 happens that individual participants have their own agenda and every interpretation that the researcher makes must be respectfully treated with some degree of suspicion. Let us now turn to the three cases.

3.2. Case 1: The Bank

The focus of the studies conducted at the bank was use quality requirements for a teller system. Holmlid (2002) has also reported another account of these studies. In total, 30 hours of observation and situated interviews were conducted, as well as 17 half-day workshops.

Modelling Workshops

Initially the use of the teller system was modelled in a series of 14 workshops at the bank. Several tentative models of use quality for the teller system were developed, and a new online course for learning to use the teller system was designed within the bank organisation. The participants included two active researchers functioning as usability experts and interaction designers, a project leader at the bank, a bank employee who had developed a previous online course for the teller system, and a developer who had implemented the course. Notes were taken throughout the modelling workshops and shared representations on large sheets of paper and on the whiteboard were documented. After every workshop the two researchers spent a couple of hours on analysing the events of the workshop and reflecting on them.

The first half of the series of workshops aimed at formulating and prioritizing use quality design objectives (see below under the heading 3.5 Procedure of Analysis). These workshops were facilitated by one researcher and they circled around transcripts from earlier user studies (see Holmlid (2002) for an account of those). Relationships between different qualities were discussed, as well as the meaning of different qualities. Whether or not a specific quality should qualify as a design objective for the online course was also addressed. The participants were encouraged to identify and link use qualities, based on the material and based on their personal experience.

The second half of the series aimed at creating and evaluating design concepts for the online course, based on the design objectives identified in the first half. One researcher, acting as a designer, led

these workshops and they circled around the design concepts that were being developed.

Field Studies at Local Branches

In addition, five clerks at four branches were tracked on two occasions for half a day. The first round of field studies took place before the participants had taken the newly developed online course, and the other round took place six months later; after they had taken the course. The researcher took part of their work, took notes, and asked questions. In total, 30 hours of observation let us learn more about their work and allowed us to ask probing questions about episodes that took place.

The branches and the clerks who participated were chosen since there were clerks there that had not had any formal training in using the teller system. This criterion was necessary, since a new online course for learning to use the teller system was developed within the project. We also wanted a variation of different kinds of branches and had both large and small branches both in the countryside and in cities.

The purpose of the field studies was to detect consistent and conflicting patterns of thought and practice, and to put them in relation to the results of the modelling workshops. The field studies were guided by the research framework of multiple aspects of use and of use as mediation, as well as the notion of use qualities.

The time spent on participant observation was small, instead they relied more on interviews and short-period observations as main source of empirical material. The interviews were conducted in situ, as events unfolded or at least in the same physical context as events inquired into had occurred. Local objects, persons and events, cued the interviews and participants could point at things and explain what they meant.

Interpretative Workshops

Finally, interpretative workshops were conducted. A project team at the bank analyzed the written up field notes from the field studies during three 3-hour workshops. The team consisted of three learning developers and three in-house system developers that all had experi-

ence of bank work. One researcher facilitated the workshops while another researcher took notes and manned the video camera.

In the first workshop a brainstorming method was used. The participants were asked read through the field notes from the first round of field studies before the workshop. In the workshop they were asked to approach the notes by completing the sentence: "The use of the system should be characterized by…" This gave every participant a number of use qualities that they were asked to write down on sticky notes. The participants were then asked to one by one put the notes up on the whiteboard and one of the researchers moderated the structuring of them.

The second workshop used the groupings of use qualities from the first workshop to make categories and relations that were meaningful to the participants. Before the workshop session they were asked to familiarize themselves with the groupings that they previously had made. The result of this workshop was a set of categorized and structured use qualities.

The third workshop was based on the second round of field studies and the participants were asked to read them before the workshop and write down comments and questions that they had as well as use qualities they identified and rank those qualities according to their importance. This workshop was held as a discussion about the comments, the questions and the prioritized use qualities.

3.3. Case 2: The Studio

A field study of the interaction design studio at Linköping University was conducted. The specific focus was on episodes where students used resources individually and then jointly, before returning to individual use. In an e-mail questionnaire prior to the field study, the students in the studio were asked to describe episodes where the work in the studio was fun and events where it was tiresome and boring. The reason for using this questionnaire was to get an idea about what the students cared about when they were in the studio. This set the frame for further observations. Five out of six students answered the questionnaire. During the course of one design assignment, a researcher worked in the studio by a desk, and did situated interviews as well as ongoing observation. Interviews were conducted as the opportunity arose in the observation and they were triggered by episodes that took

place. About 20 hours was spent on observing the work of the six students and the two teachers, and field notes were continuously taken. The researcher has also previously acted as a teacher in the studio and before that also been a student in the same setting.

3.4. Case 3: The Home

Three prototype systems running on different multimedia platforms were developed, in order to study properties of such systems-in-use. As part of that work, interviews were conducted, both situated in peoples homes and in simulated domestic environments after trials of the prototypes. Situated interviews conducted in people's homes were made as technology tours (Baille, Benyon, Macaulay & Pedersen, 2003), where people were asked to show and tell what technology they had and how they used or did not use it.

Field Studies in Homes

In total, 56 hours of technology tours were made in eight homes. Field notes were taken during all interviews and most of them were audio recorded (some participants did not want to be recorded). 3-hour long situated interviews were conducted with five participants. Two of them were male and three were female. Two participants were academics of age 28, and three of them were middle-aged with children who had left home. One of these interviews was conducted as a group interview with a married couple. All of these 3-hour long situated interviews included the discussion of some speculative scenario of future technologies for sociable use.

Furthermore, interviews have been conducted with four elderly people about the technology that they had in their homes. Two were women and two were men. The elderly got disposable cameras, which they could use to document technology that they encountered. Resulting photos were used as material for conversation in following interviews. The researcher met with the four elderly in their homes at three occasions, and each participant was interviewed for ten to twelve hours in total.

Prototype Design and Testing

Throughout the project, sketches of different interactive systems for sociable use were produced as a means to make identified use qualities,

characters and patterns more concrete. In this way the sketch can be seen as the test of a hypothesis. When an idea is expressed on paper (or in software) it is easier to judge the idea, to assess its consequences and reject or keep the working hypothesis. The sketching and prototyping accordingly play an important role in the interpretative iterations in design research in that they provide means for reflection *in* action as well as *on* action (Schön, 1983).

The more interesting ideas in the case of multimedia platforms for the home were developed into hi-fi prototypes that were interactive and running on computes in contrast to the cardboard and paper mock-ups often referred to as lo-fi prototypes. It is not the best ideas that necessarily should be developed into prototypes in design research. It is instead the ideas that you expect to learn the most from developing that should be refined. Houde and Hill (1997) describe three dimensions of prototypes (see Figure 3.1): role, implementation and look & feel. A prototype can be described to put these dimensions to test in varying degrees. For example a piece of code can be written to test the technical feasibility of a certain function and it is therefore prototyping implementation. A written scenario is on the other hand prototyping the role of the interactive system in the life of a stakeholder. A non-interactive screenshot would mostly prototype the look (and not the feel) but can also be used in interviews with users about the role of the system and in discussions with programmers about the implementation. The prototypes developed in the home case were mostly prototyping role, but also, to some extent, look & feel.

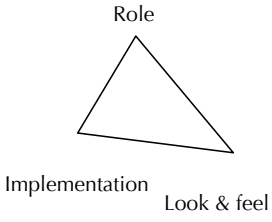

Figure 3.1: Three dimensions that a prototype can prototype (Houde & Hill, 1997, p. 369).

When highly speculative design proposals are developed it is because one expect to learn something from them rather than produce a good product. 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)

Gaver and Martin write about the function of speculative design concepts:

> …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 is disclosed 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 to us. Good design tends rather to blend in and become one with the fabric of culture; only slightly bending it to surprise the user.

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

Garfinkel (1967) 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. An example is to 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 inconcruency experiments, by utilising "provotypes," that is speculative and provocative prototypes. 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 things to be seen with fresh eyes by questioning taken-for-granted categories.

Much of the fieldwork in the domestic case was based on scenario-primed and provotyped situated interviews. Users of a technology were confronted with a future scenario by reading a text or by trying

out a provotype, and this experience set 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.

Three prototypes were developed within the case of multimedia platforms in the home. The first was a quiz game for interactive television that utilized a novel kind of feedback for allowing the players who did not have the remote control to follow the interaction. The second was an on-demand news service for interactive television that made use of two remote controls. The third prototype was a multimedia platform with multiple devices (tablet computers, mobile phones, television et cetera) that provided space for individually parallel activity but also for coordinated joint activity.

During prototype testing, 21 testers were observed during usage, and interviewed afterwards about their experiences. In total, 7–8 hours of observations and semi-structured interviews were made during these tests. The ages of the participants ranged between 21 and 30 years, and half of them were male and half were female. All of them were considered to have a high degree of computer experience. The tests took place in environments that looked like somebody's home but it was still obvious that nobody lived there. The reason for not testing it at home with the testers is that it was quite cumbersome setting the system up.

The first prototype was a quiz game for interactive television, and eight users tried it in pairs. They were interviewed afterwards one by one. The researcher took notes both during observation and during interviews. This prototype is presented in more detail in Chapter 4.

The second prototype was a news on-demand service, and it utilized two remote controls for simultaneous input. Five pairs of testers tried it, and they were interviewed in pairs after the session. One initial session was also held with three participants that surfed online news with one remote control.

Field notes were taken during all observations and interviews, and six of the ten sessions were audio or video recorded. The test sessions, including interviews, lasted from 30 minutes up to one hour. The news on-demand service is described in Chapter 4.

The third prototype system that was designed was the multimedia platform, which was based on multiple stationary and mobile devices and it was called LOCOMOTION. In contrast to the other prototypes, it was not made for empirical reasons. It was instead made to concretise and give form to the use qualities and design patterns identified from earlier studies in an illustrative expression. This system is described in Chapter 6.

3.5. Procedure of Analysis

Two objectives were aimed at in the analysis of empirical material. The first was to identify desirable characteristics of interactive systems in co-present situations of use, and describing them in terms of use qualities and character. The second was to find design solutions that have the potential to provide those desirable characteristics and express them in terms of design patterns. The first objective is addressed in Chapter 5 and the second objective is addressed in Chapter 6.

This process was guided by the concepts of multiple aspects of use as well as use as mediation. A meta-process in the form of reflection on the theories-in-use (Schön, 1983) took place in parallel to the work with the empirical material and the design work. The reflection (which is reported in Chapter 7) focused on what the different concepts disclosed about the empirical material, on what they did they not disclose, on how they were applied and on their strengths and weaknesses.

Use Quality Analysis

All written up and transcribed field notes and design sketches (ca. 500 pages) underwent an analysis of use qualities, but the analysis actually started at the time of entering the field and scribbling down the first letter in the field notes. Transcriptions and field notes were read and re-read by several researchers in order to provide triangulated interpretation. Three methods were used in the use quality analysis. Two of them are common in social sciences: the concentration method and the categorization method (Kvale, 1997; Ely, 1993). The third is

common in engineering design: the objectives tree method (Cross, 2000; Jones, 1992). Finally the three settings of sociable use were compared to each other to find similarities and differences in desirable use qualities.

The concentration method was firstly applied to the material. The first step of that was to get a feeling for the material by reading through the written up and transcribed field notes and listening or watching the recordings. The second step was to find meaningful episodes in the texts where participants expressed their view on the use of interactive systems in sociable use or when observations regarding the same issue had been made. The third step was to concentrate these meaningful episodes in the text to short phrases that expressed a central theme from the perspective of the participant, and this theme was scribbled down in the margin. The fourth step was to put the question of what the sociable use should be characterized by to the meaningful episode. This provided an initial list of desirable use qualities.

In Kvale's description of meaning concentration he suggests a fifth step, which is to connect all the meaningful and necessary themes to a descriptive text of what the participant's view on the subject is. This was not perceived as necessary for the purpose of developing use qualities but it can be a good idea to do if they are to be connected to a user profile or a persona (Ernfridsson, 2003).

The categorization method was furthermore applied to the empirical material. The first tentative categories of use qualities were formulated by marking expressions in the texts describing how it was or should be to use an artefact in that situation. Descriptive qualities were transformed into prescriptive qualities (e.g. 'difficult to go between systems' turns into 'seamless tool integration'). The qualities developed were partly based on the theoretical framework of use as mediation as well as on previous research on sociable use situations and joint activities (as described in Chapter 4), but it also relied heavily on what that emerged as meaningful categories in the text. The number of categories of use qualities identified was at this stage vast and in order to get a more manageable set the method of affinity diagramming was applied. This means that the categories were grouped and sorted according to their affinity to each other and higher-level categories were formed as the groups were named (Ely, 1993; Holtzblatt & Beyer, 1993).

At this stage the categories could be added to the list of desirable use qualities that had started to develop in the concentration analysis. This list of categories was used to code the empirical material and I performed the coding in all of the three cases, but in the bank case one other researcher as well as different workshop participants performed this coding and the coding of different people were in the end combined. In the home case, three other researchers have participated in the coding, and in the studio case I have been the only researcher who has coded the material.

The qualities were, during the coding, tied back to excerpts from the empirical material to make sure that nothing had been lost in the abstraction. Finally, the instrumental, communicative, aesthetic, constructional and ethical aspects of every use quality were described in order to cover all potentially meaningful aspects of them.

The objectives tree method, where the desirable use qualities were regarded as design objectives, was at last applied. The list of use qualities became, in this analysis, a list of objectives to design for, and that list can be prioritized. The objectives were clarified by posing questions of 'why?' 'how?' and 'what?' To give an example, 'why is this use quality desirable?', 'how can it be achieved?' and 'what implicit objectives lies behind the stated ones?' This will provide a hierarchical means-ends structure where some objectives are not ends in themselves but rather means for other objectives. The affinity groups made in the categorization were used in this analysis to provide a starting point for the analysis.

After the analysis of every case in isolation, the three cases were compared to uncover similarities and differences.

Analysis of Characters

The analysis into different characters was approached in a similar but slightly different way. The categorization method was applied by looking at actions that were performed by means of the interactive system. Every identifiable action was coded based on the roles of the participating users in the mediated activity, the role of the interactive system and the role of the object that the action was directed at. The roles were then related to the different perspectives and characters trying to identify when the interactive system had the role of a tool, a medium, a dialogue partner, a system component, an arena, and a

machine. New categories were created when neither of these categories fitted the identified roles.

Development of Design Patterns

Conflicts between desirable use qualities were especially noted during the use quality analysis since they form a basis for the problem statement in design patterns in terms of conflicting forces. When a problem of conflicting use qualities or tensions between use qualities had been identified the next step was to identify features of situations where the use qualities were not in conflict. If such a feature could be identified it could be a solution to the tension, and then a design pattern could be written.

Design patterns are built upon a problem-solution pair. The problem is in this thesis treated not as an objective fact, but rather as tensions between different forces in terms of needs, wants, desires, hopes, wishes and passions. The solution can be regarded as a trade-off that relieves this tension.

As mentioned in the theoretical chapter, applying a pattern lead to guidance in the judgement of a composition. It may also lead to inspiration for a composition, but a pattern is not an objectively applicable truth.

Given that every design situation is particular and unique, generalized design solutions as patterns that are documented to have worked in other design situations may sound as a futile approach. This is, however, not the case. Studying earlier designs helps a designer become aware of specific qualities and judgments that the designer needs to do in their unique design situation. An immersion in past design projects and helps a designer create a sensibility and appreciation in their composition of a new particular design, but it does not provide pat answers for future designs (Nelson & Stolterman, 2003).

A pattern is a formalized version of a guiding image of the ideal solution that can resolve the tensions of that-which-is-desired (the desideratum). Whenever such tensions occur in a design situation the patterns should be able to provide a designer with inspiration and appreciation as well as sensitizing him or her to the qualities of the design situation. A pattern is always tentative, generic, and unspecific, while still being concrete, so that a designer can look at it and see whether it has any merits for his or her particular design situation. By being un-

committed to details, it has the potential to open up a space of possibilities rather than pre-maturely constraining the design to a single solution.

3.6. The Particular and the General

A common criticism against interpretative case studies is that it is difficult to generalize to other populations, situations and persons that has not been studied. Firestone (1993) gives a short reply to this criticism: 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.

Transferability

There is often no attempt in qualitative case study research to generalize to a general case. Instead, the goal is to maximize transferability of knowledge from one particular case to another particular case. In order to enhance case-to-case transferability, thick descriptions (Geertz, 1973) are often 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.

Four Kinds of Generalization

Walsham (1995) identifies four kinds of generalizations that can be made from interpretative case studies: (1) development of concepts, for example the concepts of automate and informate—Zuboff (1988); (2) the generation of theory, for example the development of distributed cognition—Hutchins (1995); (3) the drawing of specific implications, for example how breakdowns and focus shifts can be used for identification of problems of mediation—Bødker (1996); and (4) the contribution of rich insight, for example the difference between plans and situated action—Suchman (1987). Interpretative case studies often make several of these kinds of generalizations.

Abstraction

The process of relating the particular and unique cases to theoretical concepts is called abstraction (Klein & Myers, 1999). This process can 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 abstraction is achieved by relating the observations to theoretical concepts and by that contributing to the development of theory or perhaps to understanding of 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. The relation to theory in interpretative research is what clearly distinguishes it from anecdotes; observation is driven by theory as well generating theory.

In this thesis the empirical material is related back to the theoretical constructs of use qualities, characters, patterns, multiple aspects of use and mediation. The results of this abstraction-process are reported as reflections in Chapter 7.

From the Particular to the General and Back

The purpose of a case study is to gain knowledge of 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 design, every design situation is particular and design is therefore a treatment of the particular (Nelson & Stolterman, 2003). The research in this thesis moves from the case studies where the particular and analogue stream of human activities are interpreted as that-which-is as well as that-which-is-desired. These are formalized to more general categories and themes of qualities, characters and patterns. This more general knowledge is then taken back to the particular in a design composition in the form of the multimedia platform LOCOMOTION.

3.7. In Summary

The research problem was stated as what appropriate units of analysis are in interaction design for sociable use, starting out from the concepts of *multiple aspects of use*, *characters, design patterns* and *use qualities*. It is approached by putting the applicability of the concepts to test within a collective qualitative case study. In total, the empirical work includes 49 participants met during 41 observation and semi-structured interview sessions ranging from one to four hours, and 17 half-day workshops.

The three cases of professional use of computers in customer meetings at banks, educational use of computers in a design studio and leisure use of multimedia platforms in the home were chosen based on the perceived opportunity to learn, variety and contrast.

The focus of the studies conducted at the bank was identification of use quality requirements for a teller system. The work included modelling workshops, field studies, and interpretative workshops.

In the studio case, participant observation was made. The focus was on episodes where students used resources individually and then jointly, before returning to individual use.

In the home case, three prototype systems running on different multimedia platforms were developed, in order to study properties of such systems-in-use. As part of that work, interviews were conducted, both situated in peoples homes and in simulated home environments after trials of the prototypes. Prototypes and scenarios worked as provocations to stimulate discussion and tease out the taken-for-granted of everyday life.

Field notes from the three cases were analyzed into use qualities, characters and patterns by applying the concentration method, the categorization method and the objectives tree method. Design patterns were developed by framing tensions and conflicts between desirable use qualities as problems and features that had the potential to solve these tensions were put as solutions.

The research process can be describes as going from the particular shades and nuances of the case studies of sociable use, to the general use quality categories, characters and patterns that in turn are made concrete in a particular design solution.

Finally, generalizations in the form of case-to-case transfer and abstraction to theoretical concepts are possible based on the qualitative case study approach to design research taken in this thesis.

4. Case Settings

This chapter describes the settings of the cases in the collective qualitative case study that forms the empirical basis for this thesis. Firstly, it outlines the different approaches to design of interactive systems for sociable situations of use as it is described in the literature of computer-supported cooperative work (CSCW) and human-computer interaction (HCI). Secondly, it describes the professional use of computer systems at the bank, the educational use of computers in the interaction design studio and the leisure use of multimedia platforms in domestic environments. The descriptions of the three settings start out with a review of the relevant literature and then describes the activities in the settings, the people involved, the structural resources that are utilized, and the conditions under which the agents work in terms like time-pressure, and formal and informal demands.

4.1. Sociable Situations of Use

There are at least three discernable types of approaches to the design of interactive systems for co-present sociable situations of use. There are single display solutions that utilize several input devices to a shared screen. There are also multiple display solutions where individual actions are performed on a private screen while public actions are per-

formed on a shared screen. There are finally, computer-augmentation solutions where computational power is embedded in the existing physical environment.

The term 'groupware' is used to denote software that is used by groups to enable cooperative activity. Since users of groupware act both as individuals and as members of groups, designers are required to aim to support both (Baecker, 1993; Ishii, Kobayashi & Grudin, 1993). Users need to be able to move fluently between individual and group activities, between working in their individual ways and working collaboratively according to their communicative practices. In these mixed-focus situations (Gutwin & Greenberg, 1998) people switch back and fourth between individual tasks and shared work undertaken with others.

An example of a mixed-focus situation is consultation meetings where clerks have a need to explain something and then swivel their screen towards their customers (Scaife, Halloran & Rogers, 2002; Holmlid, 2002; Arvola, 2003a, 2003b; Rodden, Rogers, Halloran & Taylor, 2003). Another example is when people in control rooms work individually during normal situations, and collaboratively when something go wrong in order to construct a shared understanding and regain control (Garbis, 2002). Similar events take place when designers turn to a colleague for help, or is curious about the other's work, want to coordinate, get client requirements, integrate components and so on (Bellotti & Bly, 1996; Sachs, 1999; Geisler, Rogers & Tobin, 1999).

Only little friction is tolerated in the use of groupware for co-present collaboration; if the system is not easy to use it diverts attention from the social interaction (Stefik, Bobrow, Lanning & Tatar, 1986; Rønby Pedersen, McCall, Moran & Halasz, 1993). Wiberg (2001) denotes this the divided attention problem. Interactive systems often distract us temporarily from our real work, when they instead should offer seamlessness, so that unnecessary frustrating seams are done away with. Ishii, Kobayashi and Grudin (1993) argue that seamlessness is particularly important for groupware, since collaborative work is characterised by constant shifts among a variety of modes and spaces of working. One of those seams, or gaps, is the previously mentioned one between individual and group work.

That gap cannot be characterized as rigid states where objects and systems are either completely public or completely personal. Instead, people need to fluidly move their objects of work in subtle and lightweight ways, between personal and public states including the gradations between (Greenberg, Boyle & Laberge, 1999). In addition, the terms 'public' and 'private' need to be understood in a relative fashion. Little of what we in commonsense understand as private is actually done in isolation from others, and only a subset of public activities are performed in complete mutual participation between ratified authorized individuals. When we understand something as private it is in relation to something else; work in a cubicle is for instance more private than work in a meeting room. (Goffman, 1981; Geisler, Rogers, & Tobin, 1999)

In everyday activities, people take advantage of the physical properties of artefacts in order to move between private and public activities. Physical objects are for example often both locally mobile and micro-mobile. Local mobility is when an artefact can be moved within a site. A printout of a plan can for instance be brought to a colleague for consultation. Micro-mobility means that objects can be tinted, moved twenty centimetres, sorted or turned upside down. When for example a piece of paper is turned away from others it is no longer accessible for them, and when it is handed over to another person both control and responsibility are visibly transferred. Both local mobility and micro-mobility are therefore important awareness and coordination mechanisms (Bellotti & Bly, 1996; Luff & Heath, 1998; Bång, & Timpka, 2003). Awareness can be seen as an understanding of the activities of others, which provides a context for your own activity. That context is used to ensure that the individual contributions are relevant and timed to the activity of the group (Dourish & Bellotti, 1992).

In design collaboration, argumentation often takes place in a public workspace, but much of the work takes place in a private workspace. Geisler and Rogers (2000) have modelled this integration in design collaboration in terms of six stages of collaboration forming a trajectory from private to public and back again: From private work over to sharing, proposing new routes to follow, discussing implications and issues, ratifying proposals, updating their current understanding of their work, and finally disseminating back to private work.

This shows how a mixed-focus situation may entail several kinds of actions that can be on different places along the trajectory between individual and group work.

The collaboration in a mixed-focus situation may, furthermore, be characterized as either symmetrical or asymmetrical (Scaife et al., 2002; Rodden et al., 2003). Symmetrical collaboration is the kind that has received most attention from the CSCW-research. In symmetrical collaboration people work together as part of a team, for a common purpose, but in asymmetrical collaboration people work together as parties that need to collaborate to achieve individual goals that are mutually interdependent. The mixed-focus between individual and group work is much more salient in asymmetrical collaboration where people have private agendas than in symmetrical collaboration. A private agenda may lead to that some information is kept from the other part (e.g. the amount of commission that a travel agent is earning on a particular trip).

Gutwin and Greenberg (1998) point out two potentially conflicting user requirements for groupware in mixed-focus collaboration: Workspace awareness of what others are doing, and individual powerful control over the interactive system. They show how the tension can be reduced in different cases of synchronous distributed groupware, and some of their points are also valid for synchronous co-present groupware, as in the three cases of this thesis. Gutwin and Greenberg suggest that in order to support both workspace awareness and individual control, one can provide secondary views where a user can track the work of others, while working individually in their primary view. They also put forward highlighting of actions by visual indication or sound, as a way to increase the workplace awareness, but the highlighting should not be too strong since it may be distracting..

Previous research on design of interactive systems for co-present mixed-focused collaboration can be structured according to the kind of groupware solutions that they employ: single displays; multiple displays; and interactive spaces. These three approaches will now be reviewed.

Single Displays

Single display groupware (SDG) is software that supports face-to-face groups who work together around a single display. SDG applications

have several input devices that users can use simultaneously to interact with the interactive system. The purpose of introducing multiple input devices is principally to encourage and enable participation by all people that are part of the activity. Multiple input devices enable users to work concurrently on the same object or on separate objects. (Stewart, 1999; Stewart, Bederson & Druin, 1999)

SDG have for instance been used for central display surfaces in meeting rooms, and one example is the LIVEBOARD: a stylus-based, interactive, large area display, which has been found to be useful for drawing, showing, and explaining things in planned and unplanned meetings. (Stefik, et al., 1986; Elrod, Bruce, Gold, Goldberg, Halasz, Janssen, Lee, McCall, Pedersen, Pier, Tang & Welch, 1992; Rønby Pedersen, et al., 1993)

Another area of application, which has been investigated, is in classrooms where children are encouraged to cooperate. The research has shown that children, given the opportunity, take advantage of the ability to interact concurrently with the computer. It has also shown that the children's communication can be constrained when forced to take turns in controlling a traditional PC. (Stewart, Bedersson & Druin, 1999; Benford, Bederson, Åkersson, Bayon, Druin, Hansson, Hourcade, Ingram, Neale, O'Malley, Simsarian, Stanton, Sundblad, & Taxén, 2000; Scott, Shoemaker & Inkpen, 2000; Shoemaker & Inkpen, 2001)

Using multiple input devices to a single shared screen as a way to bridge the gap between individual and group work, leads to a number of other design problems. Firstly, there is the problem of identification; that is seeing who is doing what on the screen. Shared feedback and descriptive cursors are consequently needed (Stefik et al., 1986; Stewart et al., 1999; and Benford et al., 2000). Secondly, when users are seated far away from the screen (e.g. in a meeting room), there is a problem of deictic reference; they need to talk about the objects on-screen without being able to directly point at them. This is not a problem when users are seated shoulder-to-shoulder in front of an ordinary interactive system screen. Suggested solutions include telepointing and clear labelling (Stefik et al., 1986). Thirdly, there is a problem of interference between different individuals' actions on the shared screen (Stefik et al., 1986; Stewart et al., 1999; Benford et al., 2000; and Zanella & Greenberg, 2001). The work by one user may be

in the way of another user's work. Stefik, Foster, Bobrow, Kahn, Lanning & Suchman (1987) dubbed such situations "Scroll Wars" and "Window Wars." Two ways to avoid interference have been suggested: semi-transparent widgets (Zanella & Greenberg, 2001) and separated virtual rooms to work in (Stefik et al., 1986).

Utilizing only one shared screen enables tight collaboration and coordination, but it also enforces tight coordination. If someone wants to follow up a trail he or she cannot do that without monopolizing the shared screen. Shoemaker and Inkpen (2001) suggest therefore that while maintaining the single display users should be able to access and manipulate information that only they can see. Goggles that filter the information from the screen is one way to obtain such a function, another way would be to display information so that only people who know what to look for can see it (Intille, 2002). Introducing privacy in a single display solution allow users to work more independently and also switch back and fourth between collaborative and individual work. Mixing private and public information on the same screen might be advantageous since it makes the distance between collaborative work and individual work short, but if such a solution is chosen it must be indicated what information is shared and what is private.

Multiple Displays

Another way to allow both individual work and collaborative work is to use multiple displays. Multiple displays that are side-by-side have the advantage of a single shared display in that users see the other persons' actions and can point on the others' screen. Having your own screen also adds the advantage of being able to work on individual projects without interfering with the other too much. If the objective is to force people to work tightly together a single display might be better. (Scott, Mandryk & Inkpen, 2002)

The LIVEBOARD was originally used at Xerox PARC as part of a larger electronic meeting room system called COLAB. In the COLAB, groups of two to six people were working collaboratively using personal workstations and a LIVEBOARD. Originally COLAB enforced strict WYSIWIS (What You See Is What I See), which means that everybody see the same thing: participation and shared view are fronted issues. The purpose of WYSIWIS is to make it possible to se what others have done and what work is in progress. Later on the designers of COLAB

created a relaxed version of WYSIWIS where users had personal windows on their personal screens in order to keep personal notes and individual information access. Relaxed WYSIWIS reduces interference and allows decompositions of work into parallel actions. In order for parallelism to work, a task must be decomposable into smaller actions that can be performed rather independently by different participants. If the parallel actions are too small they will be too interdependent, and interference will preclude any parallelism. A design trade-off in relaxed WYSIWIS is to decide how much information that should be placed in private views and how much that should be in public view, and also how to indicate what information that is private and what information that is public. When the designers of COLAB moved the process of entering text to private displays users expressed frustration at not being able to see what others were doing. The grain size at which transitions between individual and group take place still remains an open issue. (Stefik et al., 1986; 1987)

A starting premise for COLAB was that serial access to technology obstructs equal participation, but even though this is true, as shown by for example Stewart, Bedersson and Druin (1999) and Scott, Shoemaker and Inkpen (2000), serial access also has benefits. When only one person is in control the roles are visible at a glance, and changes to objects of work are transparent in the actions that are visibly performed by the person who is in control. In the COLAB environment, this means that many of the practices associated to meetings (rising to go to the chalkboard, or physically taking over the keyboard) can be regarded as resources for the participants so that they see what is going on and get a ground for fluidly changing roles. In the COLAB this meant that the group would have to start by settling assignments before starting to work in parallel and after some time of parallel and individual work they would loose track of what others were doing and of what to do next, and would therefore stop working so that the group could re-assign tasks. Individuals might, however, not arrive at these transition points at the same time and might not be equally interruptible at any given time. In order to handle that lack of orderly turn taking the group would develop cycles of regrouping, summarization, joint planning, and parallel action. (Stefik et al., 1987)

Interference is a problem, not only with single-display solutions, but also with multi-display solutions. When utilizing multiple displays

it is, however, a smaller problem since people have personal workspaces to work in with their individual activities. When people work in parallel on individual projects, or when larger groups form subgroups, some awareness mechanisms are required in order to keep track of what others are doing and keep an overview of their activity. (Stefik et al., 1986)

PEBBLES (PDAs for Entry of Both Bytes and Locations from External Sources) is a more recent multi-display project, which focus on how computing functions and the related user interface can be spread across all computing and input/output devices available to a user, forming multi-machine user interfaces, or MMUIs. PEBBLES is an exploration of how handheld computers can augment other computers like, for instance, desktop PCs, wall-mounted displays, or laptops (Myers, 2001; Myers, Stiel & Gargiulo, 1998). MMUIs inherit the challenge from relaxed WYSIWIS and private versus shared displays. How can one show only the appropriate information in each place, and how is fluid transfer of control and information among private and public displays enabled? This is an issue, which is further elaborated by Rekimoto (1998), and Greenberg, Boyle and Laberge (1999).

Rekimoto proposes a multi-machine approach with combinations of PDAs and a digital whiteboard in order to handle parallel activities. He presents an interaction technique called pick-and-drop, which means that to move data between devices, a user taps the stylus on an object on the first display and then on the other display, at which he object is moved from the first to the second display. Individual activities by the public display are supported without monopolizing the public screen, since users can perform those activities on the PDA.

Greenberg, Boyle and Laberge also investigate combinations of PDAs and large public displays in order to learn how such a set-up can enable people to move their objects of work between public and private states. As previously mentioned, they reach the conclusion that a completely public display and a completely private display are insufficient for people to be able to move seamlessly between the two extremes. Intermediaries are needed for that, but they do not suggest solutions to what those intermediaries could be.

Interactive Spaces

The point of departure for interactive spaces is embedding displays and computers in a physical space. An idea lurking in the background is to allow people to stay with their socio-historically evolved practices and augment them with computer power. This endeavour involves, for example, augmenting physical objects by adding radio tags, sensors, and projectors in the environment (Wellner, Mackay & Gold, 1993), and it involves a tight integration of interactive systems, buildings, furniture, and other physical objects (Streitz, Rexroth & Holmer, 1997).

An early interactive space was GROUPSYSTEMS, which was an electronic meeting room developed and evaluated at, among other places, the University of Arizona and at IBM in Boulder, Colorado, with the purpose of understanding, evaluating, and improving decision making (Nunamaker, Dennis, Valacich, Vogel & George, 1991). They used microcomputers with rather limited display space, which gave them restricted opportunity to experiment with private and public windows, and multi-user interfaces (Stefik, et al., 1987).

GROUPSYSTEMS enabled parallel work and equal participation, in both large and small groups by supporting and especially structuring the decision process and task completion. The objective of GROUPSYSTEMS was to improve decision performance and task completion from the group and all individuals, by avoiding errors and premature or superficial decisions, and considering more alternatives and more information.

Nunamaker et al. tried out three styles of interaction: chauffeured, interactive, and supported style. Chauffeured style of interaction (where a single user controls a public display) provided a shared focus, promoted an increased task focus and reduced socializing, in relation to a meeting that was not computer-supported. Interactive style of interaction (all participants can enter and access information from their private workstations) was predominated by anonymous electronic communication; virtually no one spoke. The interactive style may also lead to process gains since it provides parallel communication, group memory and anonymity, but the risk of information overload increases, since everyone is entering information to the group memory. Nunamaker et al. also investigated a supported style of interaction, where all participants could enter information, but information was

accessed via the public display, and electronic communication was enabled but not dominating. If verbal communication is used the effects of a supported style are similar to that of a chauffeured style, but when anonymous electronic communication is used the effect is more similar to that of an interactive style. The risk of information overload increases even more since the participants must monitor both verbal and electronically written communication. The decision process may, however, also improve since users can switch to verbal communication at need.

DOLPHIN (Streitz, Geißler, Haake, & Hol, 1994) is a system that just like COLAB utilizes a LIVEBOARD and personal computers to create both private and public workspaces. It combines two interesting characteristics in relation to sociable use: public workspace on a LIVEBOARD with public and private workspaces on personal workstations, and it allows parallel manipulation of public workspaces. DOLPHIN is used in the OCEAN-LAB, in which Streitz, Rexroth, Holmer (1997) ran a series of experiments that showed that groups that had both private and public workspaces produced products that were rated to have higher quality. In particular, they produced significantly more ideas than groups that only had a public workspace, and groups that only had networked private workstations. Groups that only had a public workspace were less active. The combination of private and public workspaces allowed group members to work in parallel and they used the public display as a focus for discussion and coordination. The groups spent about half their time in a cooperative mode, and the other half of the time was spent in sub-group constellations or individual work. Streitz et al. draw the conclusion that the more individual work, while still maintaining enough subgroup and full group activities for discussion, division of labour, and coordination, the better the quality of the final product (a design concept for a television channel). The ideas from OCEAN-LAB have eventually evolved into the i-LAND environment where interactive systems, building, and furniture are tightly integrated. (Streitz, Tandler, Müller-Tomfelde & Konomi, 2001). The i-LAND environment utilizes an interactive wall, an interactive table, computer-augmented chairs and desks, and a mechanism for moving information in space by assigning it to physical objects.

Geisler, Rogers, and Tobin (1999) report work on collaborative systems in the DESIGN CONFERENCE ROOM and the COLLABORATIVE

CLASSROOM designed at Rensselaer Polytechnic Institute. They suggest that multidisciplinary collaboration is a situation that is, to a high degree, characterized by mixed-focus between individual work and group work. The basic idea behind their "public collaborative system" is to interweave conversation in physical space with information exchange in the virtual space by (a) lines of view to systems, (b) lines of sight between people, and (c) lines of control between the users' private systems and the public systems. An example of another similar design studio is the i-LOUNGE developed at Stockholm University and the Royal Institute of Technology (Sundholm, Artman & Ramberg, 2004).

The ROLF laboratory is a command and control environment developed at the Swedish National Defence College. It is built using a large digital table and personal workstations for the military staff members. The idea is to create a mobile operative command and control centre where the ROLF environment is built into containers carried by lorries. (Brehmer & Sundin, 2004)

GROUPSYSTEMS and other interactive spaces dedicated for meetings do not support unplanned lightweight encounters very well. In order to deal with meetings that take place in the hallway or in the schoolyard, some multiple display systems based on handheld devices alone have also been suggested. (Wiberg, 2001; Danesh, Inkpen, Lau, Shu & Booth, 2001)

THE TRIP is an interactive system for planning a trip and developing an itinerary, and it runs on a platform called the ETABLE. It is designed to be used in meeting between travel agents and their customers (Scaife, Halloran, & Rogers, 2002; Rodden et al., 2003; Halloran, Rogers, Rodden & Taylor, 2003). The purpose of it is to support more equitable work in the asymmetrical two-party collaboration where the agent usually takes over most of the work of planning a complex trip, for example a round-the-world trip. The technology is usually set up in such a way that it difficult for a customer to get involved. Another design goal is to offload some of the cognitive work involved in the situation. The ETABLE MARK II is a configuration that provides three integrated large displays that are embedded in an oval table, by which a customer or a pair of customers can sit or stand side-by-side with a travel agent. The results of testing THE TRIP showed that the agent and the customers could develop an itinerary much faster than with traditional brochures and interactive systems, since they did not have to

search and coordinate the brochures, and they did not have to revise and translate pen-and-paper plans. The participants also explored more alternative solutions in this shorter time, since it was easier to compare effects of a certain choice. Since the participants sat side-by-side there was less expectation for direct eye contact, and their focus was on the screens. The shared representations reduced the need for agents to explicitly leave their customers, translate what they were doing, and for the customer to ask for clarification. All of this together helped reducing social awkwardness, and contributed to more equal roles and more continuous social interaction. The system was generally controlled by the agent and the customer made suggestions as to what to do next, and some times the agent turned control over to the customer telling him or her to "drive" the system.

BLUESPACE is a prototype cubicle workspace with the goal of addressing needs of privacy, concentration and personalisation for office workers (Lai, Levas, Chou, Pinhanez & Viveros, 2002). The pre-design interviews identified a need to create privacy on-demand to improve concentration, as well as support for dyadic interactions in the otherwise private workspace. The BLUESPACE prototype also uses a range of sensor technologies to measure lighting, temperature, humidity and noise. Sensors and active badges also detect people in the room. A number of displays are used in the workspace, and the first is located at the entrance and it displays, for instance, the name of the occupant, interests, and current availability. The other two displays are mounted on articulating arms. One display is intended for individual work and the other for peripheral information or collaboration. In addition, there is a so-called everywhere display projector, which is a steerable projection system used to display images onto any surface in the workplace (Pinhanez, 2001). The arrangement of the displays allow the office occupant to easily reconfigure the workspace between an area that supports small group collaboration and one that supports individual work. The two displays that are mounted on arms are fastened to a rail, which travels the width of the workspace. This allows users to position the screens anywhere in the area at any angle, hence providing micro-mobility. Since BLUESPACE utilizes active badges, any visitor can be detected as he or she enters the workspace, and confidential or private information is immediately hidden or replaced with a more public view.

4.2. The Three Case Settings

All three cases (*professional use* of computer systems at the bank, *educational use* of computers in the studio and *leisure use* of multimedia platforms in domestic environments) are personal settings (Clark, 1996) where conversations are characterized by free exchange of turns among two or more participants, in contrast to non-personal settings where one person speaks in a monologue and there is little or no opportunity for turns by members of the audience.

It is desirable to vary the nature of the cases so that they cover different aspects of a phenomenon under study (Stake 1994). Previous research suggests major differences in desirable use qualities for interactive systems when they are used in different settings, especially between professional usage and leisure usage of software. In between professional usage and leisure usage there is a third large area of applications: learning.

The bank is an institutional setting in a way that the other situations are not. Topic, roles, structure, and some control over turns for conversation are partly set by the speech genre. However, all the situations share the features of face-to-face conversation (Clark & Brennan 1991; Clark, 1996). See Table 4.1. These are the features of face-to-face situations, and the more of these that are missing in a situation the more special skills and procedures are needed to manage the situation, Clark (1996) argues.

1	Co-presence	The participants share the same physical environment
2	Visibility	The participants can see each other.
3	Audibility	The participants can hear each other.
4	Instantaneity	The participants perceive each other's actions at no perceptible delay.
5	Evanescence	The medium is evanescent—it fades quickly.
6	Recordlessness	The participants' actions leave no record or artefact.
7	Simultaneity	The participants can produce and receive at once and simultaneously.
8	Extemporaneity	The participants formulate and execute their actions extemporaneously, in real time.
9	Self-determination	The participants determine for themselves what actions to take when.
10	Self-expression	The participants take actions as themselves.

Table 4.1: Features of face-to-face conversation.

Features 1 through 4 have to do with the immediacy of face-to-face situations, features 5 through 7 manifest the medium, and finally features 8 through 10 reflect control (who controls what gets done and how).

All situations under study are co-present and simultaneous. They are all also audible and visible. Not all actions are instantaneously perceivable in any of the situations; it is well known that actions performed on computers are not as perceivable as actions performed in physical space (Luff, Heath & Greatbatch, 1992). The three situations are also different from basic face-to-face conversation by being computer-mediated. This means that the actions performed through the computer are not evanescent and recordless.

As shown in Table 4.1, the three situations of use differ between each other on features 9 and 10, which reflect differences in control. The bank clerk enforces that through expert knowledge and superior information largely controls the bank situation. This will give the clerk interpretative precedence and gets to set the structure for the meeting. The bank situation also lacks self-determination. The clerk does not have the authority to completely determine for him or herself what actions to take since there are rules, regulations and legislations to consider. In addition the clerk not only expresses him or herself but also the bank.

In the design studio, students do express themselves, but they do not determine for themselves what actions to take. They are in a learning situation and the teachers partly determine what actions to take.

Type of Feature	Feature of Face-to-Face Communication	Professional Use at the Bank	Educational Use in the Studio	Leisure Use in the Living Room
Immediacy	Co-presence	X	X	X
	Visibility	X	X	X
	Audibility	X	X	X
	Instantaneity	–	–	–
Medium	Evanescence	–	–	–
	Recordlessness	–	–	–
	Simultaneity	X	X	X
Control	Extemporaneity	X	X	X
	Self-determination	–	–	X
	Self-expression	–	X	X

Table 4.2: Features of face-to-face communication that the three case settings have and do not have.

In the living room, participants both determine their actions for themselves and take the actions as themselves.

The three cases under study are three different activity types (Levinson, 1992). An activity type is a goal-defined, socially constructed, bounded event with constraints on participants, setting, and so on, and especially on the kinds of allowable contributions (what the allowable topic is, or what it is about). Levinson's paradigm examples include teaching, a job interview, a football game, a task in a workshop, a dinner party and so fourth. It can either be a time-bounded event (i.e. a football game) or an ongoing process (like teaching). Other dimensions that an activity type may vary on are degree of scriptedness (ranging from a pre-packaged activity to largely unscripted events), formality (ranging from the formal to the informal), and verbalness (the degree to which speech is an integral part of the activity).

Clark (1996) introduces two more dimensions especially relating to joint activities: cooperativeness (ranging from cooperative activities to competitive) and governance (ranging from egalitarian with equal roles to autocratic with one participant playing the dominant role).

There are however, yet other dimensions of variations that can play an important role in defining activity types. They include size (from two to many participants), time-pressure (from high to low), formal and informal demands (ranging from high importance of precision and quality to low importance).

The following description of the three settings focuses what actions that are performed, on the participants involved, the structural resources that are utilized, and the conditions under which the participants act, and last but not least the purposes of performing the activity.

4.3. Professional Use of Computer Systems at the Bank

Much research in CSCW has focused on symmetrical team collaboration, but only some research has focused asymmetrical two-party collaboration, where the parties have different and potentially conflicting agendas, but still need to cooperate in order to reach their individual goals (Rodden, et al., 2003; Scaife, et al., 2002). These situations are also characterized by autocratic governance (Clark, 1996) where one party have more control over the meeting than the other party. Such

situations are quite common in commercial transactions such as purchases of complex products, where the sales-person acts both as seller and consultant. Examples include travel agents, insurance companies, car sales, and bank offices. One of the cases that is characterized in this thesis is the use of computer support during financial consultation at banks, where the two parties consist of the financial clerk on the one hand, and the bank customers (usually one or two) on the other hand.

In the UK a series of long term studies have been conducted in bank organisations (Harper, Randall & Rouncefield, 2000; Hughes, O'Brien, Randall, Rodden, Rouncefield, & Tolmie 1999; Randall, Rouncefield & Hughes, 1995), where local branches and call-centres have been investigated. They show how clerks use their interactive systems in order to construct an understanding of the behaviour and history of a customer that the clerk never before has seen, in order to reconfigure the customer's behaviour. They also describe how the ideology of customer service, which is prevalent in the financial system of today, lead to the wish to maintain customer confidence. This confidence comes partly from the apparent ease by which clerks are able to manage anything the customer demands. The clerk must hence be seen as a competent professional. Competence is manifested in the way a consistent flow of routine work is kept up, without obvious gaps. Hughes et al. (1999) draw the conclusion that difficulties clerks may have in accessing and using the information technology can be a major threat to customer confidence.

At the same time, the visibility of the technology is important since clerks early on in the meeting hints to the customer that the technology provides a complete picture of the customer's behaviour and history. This sets the ground for the entire clerk-customer interaction. At occasions the screen is also used as a shared display when the clerk shows some figures to a customer.

Hughes et al. conclude that system developers need to consider how customer facing is supported, and to present the customer representation in the interactive system to clerks so that they can use them as a resource in their work, in order to achieve "business as usual" (p. 38).

Let us now turn from the area of financial consultation and compare it to another area of asymmetrical two-party collaboration, namely consultation at travel agents. Scaife et al. (2002) and Rodden

et al. (2003) has performed a series of studies in that context, and they argue for a different approach than Hughes et al. Instead of designing technology in order to support users to achieve 'business as usual' and hence maintain the practices they argue that the customer need to be activated in the meetings. They try to make the roles between travel agent and customer more equitable by introducing a novel interactional workspace consisting of multiple displays where travel agent and customer sit side-by-side, working together on shared representations. The rationale behind this solution is that the customer today is excluded during parts of the process of developing a plan for a trip, and that this is ineffective, boring, and socially awkward. This is further enforced by the set-up of the technology where travel agent and customer sit on opposite sides of a desk and the travel agent has a monitor that only he or she can see (a set-up very similar to the one at the bank). This set-up actually hinders collaboration, even when both parties are willing to engage. They observed that the customer sometimes tried to peek over the agent's shoulder at the screen, and occasionally the travel agent swivelled the screen towards the customer in order to convince the customer of something. But during these activities the customer usually is waiting and doing nothing. During tests of the novel technological set-up, travel agents and customers seemed to be more congenial, less formal, and there were fewer gaps in the social interaction. They could also be more efficient and explore more alternative travelling routes.

However, when changing the roles so that both parties can participate in the interaction other design considerations may surface. For example, in a test of an interactive tabletop Rogers et al. (2004) observes that it could be considered rude to monopolize a shared screen and momentarily exclude others. This observation was not made in the context of customer meetings, but may very well be applicable in that context too.

A Financial Consultation Meeting

In customer meetings that were observed in the empirical work behind this thesis, a consulting clerk and one or two customers met together in the clerk's personal office. The clerk used a PC with the screen turned away from the customers, and both customer and clerk utilized pen and paper. Their objectives were to get the customer's finances in or-

der, and perhaps make changes. The clerk also wanted to keep a good relation to the customer and make profit for the bank by selling financial products and services. The clerks that were observed and interviewed were mainly financial advisors for private customers rather than for businesses.

In the offices that were observed, the clerk was seated so that he or she could meet the customers when they arrived at the doorway (see Figure 4.1). On the desk they placed the documents that they were to go through during the meeting and the clerk often turned to the PC in order to get the latest information about interests and similar figures. If the meeting were about a loan the clerk would have to do extensive input to the system and was partly turned away from the customers during this time. The back of the office was for papers and files that clerks used in his or her individual work.

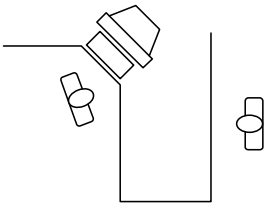

Figure 4.1: A common arrangement in an office during a customer meeting.

A meeting was usually prepared in advance so that the clerk could make a guess what it would be about if he or she had not been told. The clerks stressed that they did not want any surprises. The clerk printed out the forms, the information, and the documents that probably would be necessary to go through together with the customer. Quite often they asked the customer to read or prepare something from one meeting to the next. The collaboration was to a high degree controlled by the clerk, but questions from the customer usually led their cooperative activity in un-anticipated directions. The customer could see all the documents and forms that were laid on the table and through that draw conclusions about what they had to go through during the meeting. The clerk and the customers also cooperated by helping in maintaining each other's face. Clerks wanted the customers to feel at ease with confiding in them and to feel that their economic situation was quite common; the customer must not be embarrassed. The clerk often had to ignore the customer when there was much input into the system or when he or she had to go to the printer. The clerk would then frequently ask the customer to forgive the non-attention and the customer usually made it clear that he or she completely understood: “After all, we’ve all had to work with computers, haven’t we.”

At the bank, they are dealing with individuals’ and businesses’ money, and there is a call for accuracy from both customers and clerks. In order to be efficient, and not keeping other customers wait-

ing, 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 informants had, for instance, four log-ins and two screens open in the system owned by the subsidiary mortgage institution.

During meetings with customers, clerks switched rapidly between different systems and tools. This did not happen without friction, given the many different and un-integrated systems that the clerks use.

In order to manage the meeting, clerks needed to keep up to date with many different things. They needed to know the history of their customer, what colleagues are doing and have done, what competitors are doing, what is happening in the business, and what is going on in the present activity.

4.4. Educational Use of Computers in the Studio

Practically no research has investigated what students do in interaction design studios and how they utilize different tools and structural resources. There are, however, quite a lot of studies on architectural design studios (e.g. Schön, 1987; Sachs, 1999; Uluoglu, 2000; Shaffer, 2003), but also other studios, for example graphical design studios (Fleming, 1998). There are also a few studies on how to design computer tools for environments like studios (Geisler, Rogers & Tobin, 1999; Geisler & Rogers, 2000; Sundholm, Artman & Ramberg, 2004).

The tradition of studio learning as a way of educating designers is over a century old and it involves open-ended projects, a number of structured conversations (critique sessions or "crits"), and some kind of public presentation of the work at the end of the project (Shaffer, 2003). The idea is that learning is constructed within the projects by the student and in meetings between the student and teacher or between student and student. The formal and informal critique sessions open up a zone of proximal development (Vygotsky, 1978) where students progressively internalize processes they initially only can do assisted by others (Shaffer, 2003).

Schön (1987) investigated the architectural studio as an educational model and describes it in the following way (p. 43):

> Studios are typically organized around manageable projects of design, individually or collectively undertaken, more or less closely patterned on projects drawn from actual practice. They have evolved their own rituals, such as master demonstrations, design reviews, desk crits, and design juries, all attached to a core process of learning by doing. And because studio instructors must try to make their approaches to design understandable to their students, the studio offers privileged access to designers' reflections on designing. It is at one a living and a traditional example of a reflective practicum.

At this stage, the work in the studio sounds quite straightforward, but it is not. On the one hand, the students often only understand afterwards why they were doing the studio course in the way they did. During the course they know that they are there to design, but what does it mean to do design or think in a designerly way? On the other hand, the teachers do not know how to explain what design is, at least in the beginning of the education. Instead, it must be experienced. At this stage in learning to design, the students often feel confusion and frustration, since they try to look for something without knowing what to look for. The teachers expect the student to learn to design by doing it, and this is the paradox that the students experience. The design students are hence mainly educating themselves, trying to demystificate what design is. However, students often report that they feel that something is wrong in a design solution but they do not know why and therefore do not know how to fix it. The demystification of design, which is the learning to design, is articulation of what they already know tacitly. Schön (1987, p. 88) writes:

> In the early stages of the design studio, most students do experience the paradox of the *Meno;* they feel like people looking for something they could not recognize even if they stumbled across it. Hence, their initial learning process bears a double burden: they must learn both to execute design performances and to recognize their competent execution. But these two components of the learning task support each other: as the student begins to perform, she also begins to recognize competent performance and to regulate her search by reference to the qualities she recognizes.

As described in the introductory chapter, drawing and visual experimentation is fundamental to design. Only by drawing a solution can the consequences of a particular decision or "move" be appreciated. In design, drawing is conceived as a process of trying out design moves and discovering their consequences and not only a means for presentation (Schön, 1987). It is a threshold for many students to realize this and some students continue to for a long time regard drawing and sketching as a means for communication of already-made ideas.

The students in a studio often work with rather open time constraints. There is a deadline but they can work on their projects whenever they want. The reason is that it is not possible to control when one gets some inspirational idea and when one gets stuck in the design work. The downside of this is that students in studios often have difficulties to manage their time and much work is rushed in the last minute (Shaffer, 2003).

Quite regularly students report that they are "stuck" in their design work. This is when they do not know where to begin or how to proceed.

Progress in the studio is generally viewed as "the production of a novel design solution to the design problem within the given time period (Sachs, 1999 p. 197)." Therefore progress can be seen as the creation of the design object and in its representation. It is hence visible in sketches, prototypes and other visual representations. Sachs reports a number of different ways students could be stuck: 1) Being at a standstill; 2) taking 'too long;' not moving past the initial diagram; 4) fixation; and 5) repetition. So, how do students get "unstuck"? Sachs reaches the conclusion that one seeks help and tries to see the design in a new way. The eyes of fellow students and of the teachers are invaluable in these situations. When one is stuck it is easier to re-frame the problem with the help of someone else who may already have another view on it (Schön, 1987).

Working in the Interaction Design Studio

In the interaction design studio that was studied, six to eight students worked together. They had their own PCs and their own desks, which were covered with sketches and personal items. Two design teachers sat in private offices in the same corridor, and they could, if they wished, see the students through the large windows between the corri-

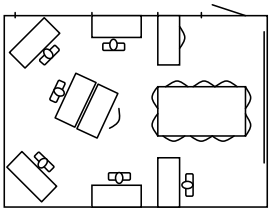

Figure 4.2: The arrangement in the interaction design studio.

dor and the studio. Within the studio the students could see and overhear each other and cooperate at the whiteboard or the shared large table, or at someone's desk (see Figure 4.2). The whiteboard was also used for projection from the shared PC, which had extra accessories such as CD-writer, drawing tablet, and scanner. Near the whiteboard and the shared table were also bookshelves with books on design and HCI.

The students considered themselves to be there to do design and deliver before the deadline, and also to learn to do design by reflection and discussion. They also wanted to have fun and enjoy each other's company, while experiencing a flow of creativity in the group. Sometimes the students considered the studio to be too noisy with people that just fooled around and were not inspired to work.

The teachers' objectives were to see every student and his or her abilities and skill in order to find ways to strengthen the student, as well as facilitating a good, creative, and friendly atmosphere in the studio. The teachers also had other courses to teach and other things to do.

The students and the teachers could easily see what others were working on by glancing at the sketches and the printed screen shots that the students had on their desks. The possibility to see what the others were working on provided a ground for unplanned interaction and chat about their work. This created an opportunity to be helpful as well as to get help from other students. Talking to others about their work was also an inspiration for the individual student. After these shorter periods of group work it went back to individual work again (see also Bellotti & Bly (1996) and Geisler et al. (1999) for similar observations).

Students often talked across the room from desk to desk, and others that were in the room were free to join the conversation. Sometimes they stood next to someone working on-screen, and if the collaboration was tighter they had the opportunity to go to the shared table in the middle of the room in order to discuss and make joint sketches. Students also presented their work to each other and to the teachers more formally at the end of each design assignment. They usually did that by using the projector to show their demo or prototype while the others sat around the shared table. During these "critique and focus sessions" the teachers and students probed the ration-

ale for the solution as well as the process, and the objective of the sessions was peer learning.

4.5. Leisure Use of Multimedia Platforms in the Home

Our technosphere is becoming increasingly complex, and advanced technology soon penetrates all aspects of our life. Our living rooms are turning into infotainment 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. Many of these services range from information to entertainment including combinations of the two. Computer systems that are used for the purpose of entertainment and information are in this thesis denoted *multimedia home platforms*.

Just like any other context of use the home and domestic life is socially organised. The activities that take place in our everyday life 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 computer-mediated 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 avoid prescriptive models of use, since homes, home life and cultural norms vary tremendously.

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.

The desirable use qualities of IT-systems in a home context differ from those that are desirable in a work context (Arvola, 2001, 2003a). The core design issues differentiates the home context from the work context are those regarding interpersonal relations. Relations between people at home are more intimate than at work and managing intimate relations is an important goal. These issues are not as evident, even though they are present to some extent in the work context.

Other issues can 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.

Frohlich, Dray and Silverman (2001, p. 721–722) 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 most likely lead to that some other design objectives must be used:

> 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.

Hence, 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 similar qualities are important in preparation of food, household maintenance, and telework. 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, Keijer & Tollmar, 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) presents 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.

Interactive Television

As we turn from the office to the living room we find a strongly emerging multimedia platform, which is 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. Interactive television (iTV) is at the core of the trend of convergence in home technologies in general and multimedia home platforms in particular.

The digital broadcast of iTV is received 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 PCs. 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 large amounts 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 appliance must therefore be adapted to the environment it is supposed to be used in.

The most common input device to 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 since hard drives are more common. The use of hard drives and Personal Video Recorders (PVR), plasma- and TFT-screens, connections to a PC, and possibilities to surf on the Internet on the television screen pushes the marriage between the PC and television further. This will lead to that more activities previously performed in a home office move to the living room.

For the field of iTV, several divisions of *genres* might be found or constructed (see also Holmlid, Arvola & Ampler (2000)). I distinguish between interactive narrative, on-demand interactive systems 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 interactive systems.

I have chosen the former set to describe iTV-appliances, 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.

In film theory and mass communication the term genre is applied to any distinct category of products (cf. Walldius, 2001). 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. In mature fields, such as movies, the conventions are clear. The viewers have developed a good sense of identifying a comedy apart from an action movie, and the producers are fluent in the filming language of comedy vs. action movies. Within a genre there are common elements of design that sets it apart from other genres of design.

The genre of interactive narratives combines 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 par-

ticipation, 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 interactive systems can be defined. One is the traditional computer applications such as banking, shopping, e-mailing etc. The idea behind this is to transform the television set into a computer screen. 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, for example interactive statistics added on to a broadcast from a sports event. The viewer cannot interfere with the ongoing of the story. Add-ons do not require 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 get statistics added on.

Some Notes on TV-viewing

While watching television (at least in Sweden), people are usually seated in the couch in the living room, unless they simply have it turned on in the background while they do other things. Television is often viewed in the company of others, either with friends or family. During working days, 75% of the time in front of the television is spent together with others. That figure is almost 80% during weekends (Ellegård, 2001). The family include children, parents, partners, grandparents, and so on. The exact constellation of the household may vary from single person households, to large families, or friends sharing an apartment, or perhaps elderly with visiting children and

grandchildren. People also engage in side-activities. Gahlin (1989) showed that 51% channel surfed extensively, 25% performed other tasks, 21% drank and 7% ate while watching television.

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 wish not to engage. The usage of iTV is indeed social as people sit together in front of an interactive system in shoulder-to-shoulder collaboration.

In the Living Room Couch

It was observed during the tests of the iTV-prototypes that the television screen was a natural focus of attention. A single remote control was used for interacting with the television set and the set-top box, but in the technology tours it was noticed that that there usually were other remote controls lying on the table. Viewers reported that they often conducted other activities in front of the television screen; for instance chatting, eating, drinking, knitting, reading, or even surfing the Internet on a laptop. Users of iTV basically had three joint motives when they were lying or sitting on the couch: taking it easy, being together, and/or getting engaged in entertainment or information. They may also have had individual motives as suggested by the different side activities.

The activity in front of the television set was represented in the constellation of things in the living room. If there were cookies and tea on the table the people present were probably eating and drinking. If someone had the remote control then everybody could see that that person was in charge of the viewing experience. The way a blanket was lying on the couch indicated the degree of relaxation and so on. These things were open for interpretation by anyone who entered the room, and that person could then adjust his or her own private agendas so that individual activities did not come into conflict.

In the technology tours it was observed that the television usually was in front of a wall (see Figure 4.3). There was a table a couple of meters away from the television screen, and on the other side of that table there was commonly a couch. On one or both sides of the couch there could be room for an armchair. The remote control was lying on the table where it was accessible for everybody, near a person in the

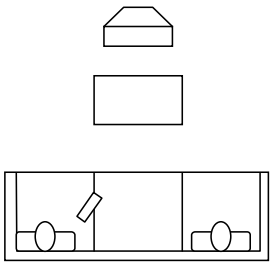

Figure 4.3: A common arrangement in a living room.

couch, or in the hand of a person. Some larger living rooms had different parts for different kinds of activities, for instance a large dinner table, a small coffee table, or perhaps a desk or a bureau. In smaller apartments there was a bed or a sleeping alcove in the same room. The exact arrangement of the living room depends on the architecture of the home, on the activities that are undertaken in the room, and also on the generation that the residents belong to.

While testing the iTV-prototypes it was noted that the remote control owner often spoke out aloud about what he or she was doing. If he or she did not, the other people in the couch had trouble following the interaction. The others often lost interest in what was going on the screen. The remote owner sometimes excused him or herself for extensive surfing. Occasionally the others in the couch told the remote owner what to do. When the remote owner felt that he or she could not decide what to do, the remote was usually handed over to another person. Sometimes the other person also asked for the remote control. When the remote was lying on the table it was considered to be free for anyone to access and manipulate, but only if that person was an equal participant: a guest in a household may hesitate to reach for the remote if not invited.

Prototype 1:The Quiz Game

On a design commission from Nokia Multimedia Terminals, I designed an on-demand quiz game for iTV with the goal of maximising the social interaction (see also Arvola (1999), Arvola & Holmlid (2000) and Arvola (2003a)). 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, 1999). The design focused on social interaction like opportunities for confrontation, deception and negotiation. The game was a turn-taking quiz game for two co-present players. It 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 (see Figure 4.4). When one player had answered wrongly to a question the turn would go over to the other player. If the answer was correct he or she got to make another move. 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.

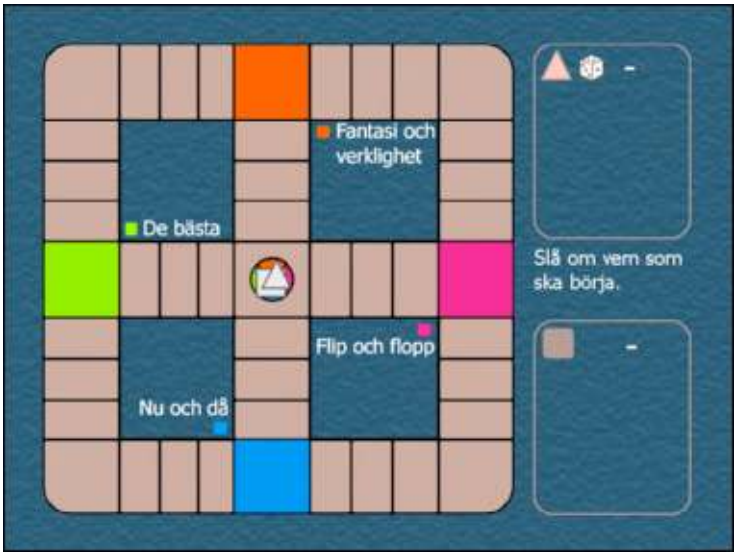

Figure 4.4: Screenshot from the iTV quiz game.

Prototype 2: The Online News Service

We also designed a service for news on demand[1], after receiving a design commission from the Electronic News Initiative; a project that explores possibilities for the news services of tomorrow (Rimbark, 2002). It was basically an interface to a local newspaper for a media terminal such as a iTV set-top box, because demographic studies had shown that 38% of the readers of Swedish local online newspapers would prefer to use their TV for reading the news (Ihlström & Lundberg, 2002). Since the work on the quiz game had shown that spending time together was important he decided to focus on that and designed the interactive system 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 testers used deictic expressions, like 'here' or 'there,' and tried to point at the screen, since it was four meters away. With that in mind, the interactive system was designed as a SDG with two game pads for

1. Magnus Rimbark was the lead designer on this project where I had a supervisory role. For detailed information regarding the project please see Rimbark (2002).

simultaneous input and a shared television screen for output (see Figure 5). 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.

It was hypothesized two remote controls would be better than one, in order to facilitate the shifts of control and hence distribute control. But the drawback was that it was difficult to see who was in charge of the shared screen and that tended to create screen wars and users were annoyed with each other.

The prototype also utilized semi-transparent menus and widgets 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 experiments (Zanella & Greenberg, 2001).

Figure 4.5: Screenshot from the on-demand news service.

4.6. In Summary

The social interaction between people is in focus when several co-present users use interactive systems. This means that it is important to make designs that do not cause any friction, or else the interactive

systems will be a distraction rather than an aid. Previous research has highlighted that users need to be able to move seamlessly between private and public activities.

There are basically three kinds of systems that have been designed for co-present users. There are single display solutions with several input devices and one display for output. Common design issues with these systems include identifying who is doing what on the screen, it may be hard to use deictic expressions when seated far away from a shared screen, and the actions performed by different individuals may interfere with each other. There are also multiple display solutions where all users have their own screen while also having some public display surface. Multiple displays allow users to work in parallel but the problem with them are that it may be hard to get an awareness of what others are doing, which may lead to coordination problems. Finally there are computer-augmentation solutions where one utilizes radio tags, sensor and projectors to mix the physical world and the digital. The wish is to interweave the computers with everyday routines and make them blend into the environment.

Three settings where interactive systems are co-presently used form the empirical basis for this thesis: professional use of computers at banks, educational use of computers in the studio and leisure use of multimedia platforms in the home. All three of these situations are co-present and simultaneous, and people can hear and see each other. Actions that are performed through the interactive systems are not always instantaneously recognizable. Another difference from ordinary face-to-face communication is that the computer medium can record, save and display the actions people perform.

The difference between the three settings is that the participants in the bank settings do not decide for themselves what to do in the situations and the clerks express not only themselves but also the bank through their actions. In the studio, the students express themselves but they do not decide for themselves what to do. In domestic environments people decide what to do (in respect to others) and they express themselves. The three settings also differ in terms of motives, time pressure and error tolerance. There are many shades and nuances that can be discerned in these situations, and more of them will be highlighted in the next chapter.

5. Desirable Qualities and Characters

This chapter addresses what use qualities and characters that are desirable for interactive systems in sociable situations of use. Based on the empirical work in the three cases, the sociable use is described in terms of participation, autonomy, extemporaneity, and politeness. These use qualities make the three case settings similar. Every quality is theoretically described, empirically described and finally they are described as design objectives. The chapter also outlines the use qualities that make the three setting different from each other, and finally it describes the characters of interactive systems in sociable use.

5.1. Participation

People who are co-present in the situation of use have projects that they do together. These projects have joint goals, shared objects and shared representations. In order to work on these shared objects, participants need to establish a common ground and to maintain coordination. This means that they need to be clear on what they mean by different terms, what they want to achieve and how to achieve it. In

addition they need to devote some of their attention to the other participants and what it is that they do. (Clark, 1996)

The usage of an interactive system is participative when the actions performed by means of it are oriented towards shared objects for a joint goal. However, as Heidegger has noted, actions that at first may be seen as individual and autonomous do in fact carry many participatory aspects; acts are never performed in isolation (Coyne, 1998). Whenever there are co-participants around even the most seemingly individual action is partly oriented towards the others.

Participation in the Professional Setting

The participative aspects of using an interactive system in the customer meetings at the bank are disclosed in three different ways. Firstly, many of the activities that take place before the actual meeting are directed towards creating common ground and a structure for coordination in order to have a smoothly running meeting in the end. Secondly, participative actions are directed at shared and public objects in the meeting. Thirdly, an awareness of the progress of the meeting as a whole is maintained throughout the meeting by glancing at the physical layout of documents on the desk.

Before the actual use of an interactive system in a customer meeting at the bank, events and activities take place that set the ground for the actual use in the meeting (an observation also made by Hughes et al. (1999) and Scaife et al. (2002)). An example from the bank:

> Clerk A opens all windows and systems that might be needed during a meeting with a customer. He says 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.

These preparations can be more or less well made; and they help the clerk to foresee what the meeting will be about, and it will be easier to establish common ground in the meeting when the clerk knows something about the customer. When it comes to the participative aspects a few things might be noticed.

Clerk 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.

Clerk B:	It is wise to keep one to two months salary as a buffer. ((explains the different kinds of SPAX the customer can choose between, one Media-related (TIME), and one IT-related)) Do you want everything in a SPAX, or parts in a traditional fund and parts in SPAX?
Customer:	((says that he wants only two thirds in a SPAX.))
Clerk B:	And the rest in interests to stabilise your portfolio? Then the SPAX Worldwide?
Customer:	SPAX Worldwide?
Clerk B:	Yes, two-thirds in Worldwide.
Customer:	OK take SPAX Worldwide. ((irritated))

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 screen is used as a common reference, but that does not democratise the meeting and the customer's autonomy is impeded.

The excerpt below shows how a Clerk C sets the ground for herself and the customer before a meeting:

Customer:	I would need some advice. I have some forest I am about to sell. Is advice free?
Clerk C:	((asks whether the customer has decided to sell.)) It is much simpler if you book a clerk in advance. Is it a lot?
Customer:	((says that she has a valuation under way))
Clerk C:	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.

All excerpts above show interesting aspects of participation, including setting the ground for the meeting in preparations, assumptions and expectations.

The second way that participative aspects revealed themselves in the use of interactive systems in the customer meeting was the participatory actions performed on shared objects.

Individuals perform participatory actions as part of joint actions. At the bank, the customer read a document before signing a contract, which is a participatory action part of the joint action of entering an agreement. In a truly joint action, all participants converge on a mutually desired outcome and all participants expect the others do their parts while also intending to do their own part. Many customer meetings are not characterized by truly joint action in that sense, since the participants may or may not have agendas that oppose the others' agendas. As in seen in the excerpt above where Clerk B sold a SPAX Worldwide to a customer, the agendas conflict and the participants perform not only participatory actions intended to be part of the joint action, but also autonomous actions without any true consideration of the other.

The third way that the participatory aspects disclosed themselves in the professional setting at the bank was when the clerk and the customer used the artefacts in the environment as trackers of the activity in order to create an awareness of the progress of their affairs. This awareness is vital for them in order to coordinate their participatory actions. An example:

> Clerk A tells the customer what he is doing with the money and the different accounts. He continues to chitchat about the customer's apartment purchase while filling in the data. He stands up going to the printer: "There will be one more document," he says on his way out through the doorway. He is back in a short while and explains what it says in the documents and then the customer signs.

Here we can see that there are a number of documents to sign and read before a contract is finally signed. In this case the number was even larger, since a creditor was needed and the customer had a record for non-payment of debt. These documents that the clerk has printed before the meeting have a non-obvious function in that they provide the participants with awareness of how much they have to do in this meeting, and how much they have done. Only by glancing at the pile of printed documents on the desk they can tell the progress of the meeting. The paper documents function not only as a contract and a relay-baton, but also as a shared record of the meeting in progress, just like a progress bar in a graphical user interface.

At the bank, the customer and the clerk coordinate their actions and accumulate common ground, they direct their attention at public objects and they keep track of the progress of the meeting. All of these are participative aspects of professional usage of systems in the customer meeting.

Participation in the Educational Setting

The students in the interaction design studio are engaged in a process of doing and seeing, trying to create something innovative with a good composition. Some design assignments are group work and others are individual. The individual assignments have, however, also vital elements of participation. Students often emphasize the need for inspiration, which often comes from other students in the studio. Below follows an excerpt from the field notes where one student is grateful for getting some inspiration from another student.

Jack:	((surfing the web)) Damn good page with links you found.
John:	It is? Cool.

Seeing the work of others lead to not only a chance of getting inspiration, but also get an opportunity to critically reflect on their own projects and they have a chance to talk about their work and perhaps re-frame their design problem. These are participatory processes where content is coordinated between two or more individuals and in order to do so they must accumulate common ground (mutual knowledge, mutual beliefs and mutual assumptions). The accumulation of common ground is one of the most important functions of the peer

learning in the studio. In order for the students to perform the coordination of content they also need to coordinate the process; they need to be aware of what the other is doing in order to know when they can interrupt. They need to synchronize the entrance and exit of a discussion, adapt it to what the others in the studio are doing and so on. In order to coordinate the process they must constantly update their common ground at a lower level than the accumulation of common ground for coordination of content (Clark & Brennan, 1991). They need an awareness of what others in the studio are doing. The following is an example from the field notes of coordination of the process:

> Jack leans back and looks at his screen. Changes position and continues to write "How is going? I'm like done now." Turns to John and walks over to his desk.

The excerpt shows how Jack declares that he is ready for a new round of joint work after working by himself for some time.

The awareness of what others are doing is important for yet another reason as well. A student can provide serendipitous input to someone else's work if he or she walks pass another student's desk and sees that he or she is working on a specific project from the papers that lie on the desk (also noted by Bellotti & Bly, 1996). The students were even aware of that others in the studio had specific systems for how they arranged their desks. The following is from the field notes taken during a conversation with several of the students:

> You don't mess around with other's stuff. But you can see what is there. Some are more individualised… made into ones own (Swedish: inbodd). Sarah, for instance, has a representation of a workflow on the desk and a categorization of different documents. But you can touch others work on their desks when you work together on a project, but you cannot mess it up. Everything has to be put back the way it was. And then you can see if people are there or not; if the screen is turned on, or if there is a jacket hanging on the chair. And you can hear what people talk about. Then you can cut in and say something and meddle in their business. That is good. (A group of interaction design students)

When someone gets stuck a common strategy is to ask someone to look at ones work (see also Sachs, 1999). A pair of fresh eyes can usually see the work from another perspective and this often helps the student to re-frame the problem and get on with the work. Whenever this happens the situations turns from individual to group work. In an email conversation one student (John in earlier excerpts) expressed it in the following way:

> It feels incredibly good to be able to throw ideas at each other and get a quick response on a thought. (Interaction design student)

It is very easy to become blind for one's own design work. Getting critique from others help a student to evaluate and reflect upon the work. In the design studio under study they regularly run critique session to where everybody present their work to the other students and the teachers and then they critique it together, trying to assess both its weaknesses and strengths.

One of the goals for the students in the studio is to enjoy each other's company. One aspect of that is sharing things. Students were often sharing information over email and instant messengers, but they often asked others to come and look at their screens too:

Jack:	I have emphasized a lot… How they should look at ah. Look at this.
((they walk over to Jack's computer and John sits down in Jack's chair))	
Jack:	Change it if you want to. I added a link, but it was hard to find the company link.
((silence))	
John:	((reading)) Yeah, but this is all right. This looks cool.
Jack:	Right.

Students often direct their activity towards public and shared objects. They work together on projects by the common table in the studio and they often present things to each other discussing different solutions. The same objects previously used in individual activity are then used in a group activity. As part of participating in studio learn-

ing, the students need to share, help each other, coordinate, critique, keep track of things and inspire each other in order for the studio to work.

Participation in the Leisure Setting

In the leisure setting, the use quality participation disclosed itself in many different ways since the informants were involved in different activities (playing a quiz game, surfing online newspapers, or showing the researchers around in their home). Participation in the leisure setting can be talked about in terms of togetherness; the state of being together in simultaneous contact, doing things by joint and combined action. For example, 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. One player said:

> It's fun, a challenge, and it's good for your ego if it goes well. (Player of the quiz game)

Another player expressed the same opinion:

> Above all, it's fun to win, see if you know anything and learn. (Player of the quiz game)

A social challenge is a safe conflict where the participants can play with roles and challenge each other (similar observations are put forward by Crawford, 1982; 2003). 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 participative 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. (Player of the quiz game)

Players of the quiz game usually bullied and teased each other, but they also found other ways to play with the norms of the social interaction, as illustrated by the following excerpt.

Isabelle:	Let's go for that category again. It was good.
Lisa:	Yeah, right! ((sounds bitter))
Isabelle:	It's two or three. Let's say the windowsill. ((gives incorrect answer and hands over the remote control))
Lisa:	((hits the dice by pressing the OK-button, moves and gets a question.)) Oops, this is embarrassing. ((gives incorrect answer)) *No!* ((hands over the remote control))

Lisa pretended to be bitter when she said: "Yeah, right!" The participants playing the quiz game were involved in a joint pretence (Clark, 1996). Throughout the game, players pretended to be angry and said insulting things to the other player, who recognized that it was not serious and played along. However, the design of the quiz game sometimes made it unnecessarily cumbersome for the players to create this joint pretence. Since they sat side-by-side their attention was directed towards the screen three meters away, rather than towards each other. This meant that it took more effort for them to attend the other person. If the players did not keep the attention partly directed towards each other they could not see when the other invited to a joint pretence. This was suggested not only by what was being said, but also what was being done in terms of posture, gestures, and facial expressions.

In terms of layering (Clark, 1996) Lisa and Isabelle are, at the first level, two old friends who are playing a quiz game and both are quite pleased and are having fun. On the second level they are bitter enemies who are engaged in a "battle of wits". On the first level all actions are serious, but on the second level they are non-serious since Lisa and Isabelle aren't *really* bitter enemies and they are not *really* engaged in a battle. Olof and Kent, in the excerpt below, created a similar situation:

Olof:	((reads the question aloud and answers correctly)) I got a piece! I'll just continue then. You cannot play, Kent.

Kent:	Damn, you are so tedious. ((both laughs and Kent hands over the remote control)) I'll have a cookie instead.
Olof:	((answers incorrectly)) *No!* ((with a moaning voice, hands over the remote control))
Kent:	Exactly. ((sounds pleased, hits the die, moves and gets a question)) Oh…
Olof:	((laughs wickedly and takes the remote control))
Kent:	((laughs))

In this good-humoured teasing, Kent responds in the same fictional domain as Olof has implied, and they stay in that domain or at least return to it quite often throughout their game session.

The point here is that the design of the quiz game makes it unnecessarily hard for the players to create this joint pretence. Since they sit side-by-side their attention is directed towards the screen three meters away rather than towards each other. This means that it takes more effort for them to keep their attention at the other person. If the players do not keep the attention partly directed towards each other they cannot see when the other invites to a joint pretence. It was observed that this was suggested not only by what was being said, but also what was being done in terms of posture, gestures, and facial expressions. Take the following excerpt for example:

Lisa:	I'll start. ((moves and gets a question)) I had never heard of him.
Isabelle:	No, right.
Lisa:	*Yes!* ((answers correctly))
Isabelle:	((smiles and has a thoughtful expression on her face))
Lisa:	((leans back and looks very pleased))
Isabelle:	((laughs))

In the interview after the gaming session Lisa was asked to compare playing quiz games as a video game and as a board game. She said:

> Everybody sits there staring at the screen and then you're not together in the same way. On the other hand, this game takes less space.

Sitting side-by-side rather than face-to-face as with a traditional board game, made it harder to tease each other, and the teasing is a vital part of challenging each other. This was most clear in the case of the quiz game but it was also a part of joint reading of online news.

As illustrated by Lisa's answer in the excerpt above, people play games and spend time in the living room in order to be together. The game should promote social interaction and unity, and it is good if it functions as a social lubricator. When comparing gaming on the screen and on the table, several had opinions similar Lisa's answer.

> When you play on screen you don't socialise; instead you look at the screen. (Player of the quiz game)

> Around a table you have more eye contact with the other players. It leads to more togetherness. (Player of the quiz game)

Participation is in the leisure case much about being together, but a good game should not only promote togetherness in the immediate sense (in the game session). It could also promote a *delayed togetherness* that takes place at a later stage. One player expressed this in the following way:

> 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. (Player of the quiz game)

The game was used as a social lubricant as described in other descriptions of games as well (Crawford, 1982, 2003; 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 in previous research. 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 fluency in the interaction (Scott, Shoemaker & Inkpen, 2000). In the on-demand news case the goal

was to further enhance participation by adding another remote control, but then co-ordination difficulties between private and joint activities increased dramatically.

The ultimate object of togetherness as a use quality is sociopleasure, 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 the immediate sense and in the delayed sense.

Togetherness is the state of being together in a group, being in simultaneous contact, and doing things jointly by participative action. A system can promote both immediate and delayed togetherness, as seen in the quiz game.

Looking beyond the specific applications that were built and tested in the leisure case, there were also many indications of participation in the technology tours. It was for instance observed that elderly people often received technology as gifts from their children. Technology in different forms was something that people could gather around, and the some informants got help from other members of the family or from friends with setting the technology up, tuning in the television channels, and similar things. One informant said that she got the music channels only so that the grandchildren would have something to look at when they visited.

Participation as a Use Quality Design Objective

When people meet they have some projects that they do together. Designers of interactive systems must be clear on what those projects are so that the usage of the system can support them or at least not interfere with them. Participation is mainly coloured by the social aspects of usage, but instrumental, aesthetic, ethical and constructional aspects are also present in this quality. The instrumental aspects of participation include how the mechanics of establishing and completing a joint project is performed. The aesthetic aspects emphasize the feeling of togetherness with others or lack thereof. The ethical aspects have to do with whom to include and whom to exclude from a particular joint project. Finally, the constructional aspects refer to the construction that can facilitate the participation. Can one for example build a sys-

tem with smaller downloading times so that the will not be that awkward silence in the customer meetings at banks.

5.2. Autonomy

Participants in the sociable setting have private agendas and activities as well as joint goals and activities (Clark, 1996). They want to perform autonomous actions unimpeded. Individual work is performed in parallel with joint work and it is either stemming from a personal interest, from using objects as tools for one's own mind, or from private agendas. Attention must, however, still be partly oriented towards others individual work so that they are not disturbed. In addition, actions that normally would be characterized as participatory, often serve individual ends as well.

Autonomy in the Professional Setting

In the customer meetings at the bank, clerks had many autonomous activities running in parallel with the joint activity that they had together with the customer. For instance they constantly kept track of what consequences changes in the customers financial behaviour could have for the profitability of the customer. They did this by keeping an eye on their computer screen.

Clerk:	Let me get that information. ((taps on the keyboard, opens the system for the subsidiary mortgage institute and checks the figures against what he previously has printed out))
Customer:	Can we include the loans we have at [another bank]?
Clerk:	((looks into what effects that would have and writes down the figures on a piece of paper and rolls back with his office chair to use the calculator))

Here the clerk uses the computer systems and the piece of paper as objects for his own thoughts so that he can meet the customer in a professional way and make sure that the customer is profitable. After the meeting, he says:

> I feel like a bad businessman, but I want to keep him as a customer. He is profitable despite the discount, but I would like to refine their businesses in the bank. They have a positive behaviour. (Clerk)

Occasionally clerks instead devoted all their attention to the computer and minimal attention to the customer. At these moments they excused themselves and blamed the computer and the routines for their inattention to the customer.

> Let's see. ((Works on the computer putting in data to it. It is quiet in the office.)) I'm only going to make this input… (Clerk)

Clerks were also concerned about the things that they did not want the customers to find out, like for example the profitability of a customer, the warnings that a system may give to a clerk, or information about other customers that the clerk could have on-screen:

> Take the new advice system for example. The barrier to using that is partly about time; suddenly the customer meeting takes two hours, and partly it's my unwillingness to work together with the customer in front of the computer screen. Let's say we are doing a calculation together. There will be long periods of waiting for connections, and then it will easily be quiet in the meeting with the customer. Then there is the problem of what I should see and what the customer should see. What is private and what is public? It feels rude to hide the screen, to turn it away, and then turn it back again. (Clerk)

Autonomy in the Educational Setting

Here follows an excerpt from the field notes in the studio case where Jack and John worked on a group assignment:

> Jack rolls with his office chair to his desk when they have divided the work. Then they work in silence. After a while Jack leans back and stares up into the roof. He changes position, and continues to write.

Jack:	How is it going? I'm like done now. ((walks over to John and they discuss)) Eh, we'll do it like this then?
John:	Yeah.
Jack:	Should they do that exactly?
John:	Eh, but… I've changed some minor things.

In this episode Jack and John worked autonomously when they needed concentration and focus. They divided the work and went to their private desks. When the different parts were completed they worked jointly again. Before this episode they sat by the shared table, sketching together on a large sheet of paper and before that they worked individually, trying to figure out how to approach the problem. Their group assignment had large portions of autonomous work.

A student commented on how good it was to have one's own computer when working on group assignments.

> It's good that you can work by yourself. It's sometimes unnatural to sit two in front of the screen. It's good that he has his own place. And that you can go away from the computers and sit by the table. Frustrating when someone sits and rests and cannot participate. (Interaction design student)

In the excerpt above, the student expresses a wish to be able to work autonomously at some times and jointly at other times.

Autonomy in the Leisure Setting

In the home case, the autonomous parts of the sociable setting showed themselves in many ways. The interests of one person in the living room could be completely different from another person, but they still wanted to spend time together. An informant using the online news service said:

> If you have very different interests, then it's a little hard, because if one is like the worst sports geek and the other hates sports, then one think it's boring as hell when he only wants to watch sports. (Tester of the online news service)

This meant that one person would want to surf on the Internet or play computer games while the partner was watching television. The following is an excerpt from the field notes from the technology tours:

> His girlfriend uses the computer to write job applications, but there are no conflicts. He says: "I sit here in the living room playing games on the laptop so that I'm a little social at the same time." (Informant in the technology tours)

If there was no room for autonomous actions they had to take turns, otherwise the passive participant could leave the room to do something else. This is also probably why people excused themselves for extensive surfing; they did something not very interesting to the other participants. A tester of the online news services expressed it in the following way:

> You cannot sit like this if you don't know each other, because then you have to say: 'Have you finished reading now so that I can read an article that I want to look at.' Since what I do affect the other. (Tester of the online news service)

Interference arose from the shared functions in the online news service. Testers 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. They said things like:

> He was in my way as soon as I was going to read something. (Tester of the online news service)

> It was strange, I was not considerate of you. (Tester of the online news service)

One user's actions came into conflict with the other user's actions since they could not perform autonomous activities on the shared object. Instead, there was an expressed wish from testers to be able to work in parallel. In a complex task where both users can perform one subtask each side-by-side without interrupting each other, they can perhaps 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, Bederson & Druin, 1999).

Autonomy as a Use Quality Design Objective

When people get together co-presently they still have private goals and agendas. They want to act autonomously in parallel with the participation. Autonomy is mostly tinted towards the instrumental aspects. The system is used as a personal tool to aid with something. This shows itself when they for instance cannot perform autonomous acts without interfering with each other. However, the other use quality aspects are also present. The social aspects are there since no act is performed in isolation, but always in respect to the joint projects. The aesthetic aspects show themselves in the frustration of not being able to do your own things. The ethical aspects include things like privacy and secrecy; what objects do a user want to keep hidden from others? Finally, the constructional aspects of autonomy are how it is all realized. How is for instance the network set up so that our informant can sit in the living room playing computer games, wireless and secure, while his girlfriend watches television.

5.3. Extemporaneity

Whenever people meet in dialogue the outcome is somewhat unpredictable and spontaneous (Clark, 1996). Acts are performed on the spur of the moment, often unexpectedly. What previously was private may therefore, in a serendipitous interaction suddenly be needed for joint actions. Since individual and joint activities run in parallel and feed into each other an impulse that change the activity can come from any direction or source. A joint activity can spur an individual trail of thought and action, and what someone else does individually can also do so. What someone does for him- or herself can also feed into a joint activity.

Extemporaneity in the Professional Setting

At the bank we could observe how this extemporaneity affected the use of the computer systems. Take for example, the following excerpt from an interview:

> 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! (Clerk)

To avoid this from happening clerks worked autonomously preparing the next meeting and finishing the last, at the same time as a new customer entered the office. The clerk needed to show and explain things to come to an agreement with the customer during the meeting. The clerk hesitated, however, to use the clerk's private screen as a shared reference, since it was full of confusing figures and codes, it showed secret information about the previous customer and it displayed the profitability of the current customer. The clerks regularly handled this by printing out information that could be shared, jointly accessed, and jointly manipulated in the meeting. This solution was, however, inefficient since unanticipated information could be needed. To share the new information with the customer they could choose between turning the screen to the customer, telling the customer what the information was, or making a new printout. Turning the screen led to the problem described above. Using only words to tell the customer and not being able to show was difficult. Making a printout took too much time, the clerks wanted to attend the customer rather them keeping them waiting.

This is a typical case of mixed-focus collaboration (Gutwin & Greenberg, 1998) where clerks switch back and fourth between individual tasks and shared work undertaken with others. The clerks needed to be able to move fluently between things that they did on their own, and things that they did together with the customer. When they worked on their own they wanted full control and powerful interaction, but when they worked together with the customer traditional groupware use qualities such as awareness, visibility, equity and participation entered. The gap between individual work and group work could not be characterized as rigid states where objects and artefacts were either completely public or completely personal (see also Greenberg, Boyle & LaBerge, 1999). Instead, clerks needed to fluidly move their objects of work in subtle ways, also over semi-public spaces like the space near the clerk where customers could see all the papers that they had to go through without having authority to manipulate. Physi-

cal objects could be placed on this semi-public space but not virtual objects. The virtual ones were restricted to the PC-screen, which is a completely private space. In order to utilize the, for coordination and awareness, important semi-public and public spaces on the desk the clerk had to make printouts. Previous research has shown that the mobility of physical objects makes it easy to show things, tint, turn them upside-down, or hand them over. These properties are vital coordination mechanisms (e.g. Bellotti & Bly, 1996; Luff & Heath, 1998; Bång & Timpka, 2003).

Extemporaneity in the Educational Setting

In the design studio the students and the teachers could easily see what others were working on by glancing at the sketches and the printed screen shots on the desks. The possibility to see what the others were working on provided a ground for unplanned interaction and chat about their work. This created an opportunity for help and inspiration. After these shorter periods of group work it went back to individual work again. Let us return to the excerpt that also was presented under the use quality autonomy:

> Jack rolls with his office chair to his desk when they have divided the work. Then they work in silence. After a while Jack leans back and stares up into the roof. He changes position, and continues to write.

Jack:	How is it going? I'm like done now. ((walks over to John and they discuss)) Eh, we'll do it like this then?
Jack:	Eh, we'll do it like this then?
John:	Yeah.
Jack:	Should they do that exactly?
John:	Eh, but… I've changed some minor things.

Jack uses two deictic expressions in the excerpt above. From reading this we cannot be sure what they refer to, but they can actually refer to any object within their field of attention. Jack could at this point need to introduce any information object extemporaneously.

Extemporaneity in the Leisure Setting

In the home we could observe how the appliances sometimes switched rapidly between having content in focus, engaging the user in interaction without concern of other participants, and feeding topics into the social interaction. The sociable activity could take any turn and the usage of the technology changed according to that.

The appliances were also used according to different styles of use. They were switching between turn-taking, parallel use, or backseat driving (when one user tells the other what to do):

> If I sit there watching and he says 'Go there. To culture.' Like when you're surfing. We can only watch he same thing and then we have to agree on what to watch. (Tester of the online news service)

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 the character and the style of use. When the goals change or when one user has one goal and the other user another goal, the character and style will also change. Take for example the following excerpt from the field notes:

> He calls himself a news freak and looks forward to get a channel that sends news 24 hours per day. To have it on in the background: He says, "It will be more like radio." (Informant from the technology tours)

In the excerpt above we see how a television either can be used in the background while other activities are fronted instead. However, whenever something interesting appears in the broadcast the usage of the television will change to have the broadcast in focus rather than the other activities.

Extemporaneity as Use Quality Design Objective

If the interactive system does not support a certain style of use or will not allow people to mix between doing things alone and together, it will hamper the fluency of the social interaction. Multi-user technology must be flexible enough to handle different styles of use (as Scott,

Mandryk and Inkpen (2002) also argues). It seems reasonable to assume that a fluent switching between using interactive systems in different ways would help users reach the temporary goals that suddenly appears in an opportunistic activity.

At first sight extemporaneity has many instrumental aspects like how to operate objects so that they can be used for different purposes, but it has equally many social aspects given that it is a quality of social interaction as much as it is a quality of interactive systems in use. Extemporaneity has to do with introducing and switching between information objects and topics in a discourse. The aesthetical aspects of extemporaneity include issues like how it feels to use a television in the background versus using it in the foreground of ones attention, or how it feels like to switch between different interactive systems. A constructional aspect that is important is how to integrate devices and software so that they can communicate well enough to realize a fluent extemporaneity. The ethical aspects are less salient in this quality, but they are there in two ways: Firstly, designers should not stop people from switching between activities if there is a need for people to do so and they feel frustrated when it takes an effort. Secondly, one could argue that switching between different objects and goals is a fragmentation of the experience of an activity, but I would rather see it as a natural flow of the activity.

5.4. Politeness

The participants in a sociable setting have a mutual wish to maintain each other's face (Goffman, 1967; Brown & Levinson, 1987). Every participant has a claim to autonomy, and do not want his or her individual actions to be impeded by others. The co-participants recognize this autonomy and do not want to impede on it. They also respect and want respect for their self-image and self-worth. Not doing so would be impolite and face threatening. When the participants set up a joint project they have to make a commitment to get some work done. Any act taken within that commitment will affect not only the public perception of the actor's self-worth and autonomy, but also that of the co-participants'.

Politeness in the Professional Setting

At the bank, it was important for the clerk not to be surprised in the meeting with the customer. They are dealing with people's money, which is an important and personal matter in our society, so there was a call for accuracy or effectiveness.

Accuracy was, however, somewhat superficial. The clerk, and the bank too, must seem trustworthy and should not loose face. There were routines for making up the cash after closing-time and during back-office work, even though it was extra work, but an error that was made in the meeting with a customer must pass unnoticed, since the clerk or teller otherwise looked like a fool who could not be trusted with the customer's finances. As noted under Extemporaneity, one of the 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! (Clerk)

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 and politeness. A similar example:

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

One of the most important things for the personal financial clerks was 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 clerks wished to be prepared before the meeting so that they were not surprised in the meeting. There were probably several reasons for this, for example that the meeting should run smoothly and efficiently. Another reason might have been that the clerk did not want to be surprised by different aspects of the customers' financial behaviour. One clerk said:

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

For the clerk it was important to create a cooperative atmosphere:

> 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 got to let the customer go.' (Clerk)

The systems in use at the bank made it more difficult for the clerk to create a good relationship to the customer, since it drove the clerk to more or less ignore the customer, which was regarded to be quite impolite. The clerk had to make excuses and had to apologise in order to keep the equity in their meeting. Computers usually entered as a topic for small talk at these occasions and then the meeting was no longer about business but rather about computers. This is part of the divided attention problem, which appears when an interactive system diverts too much attention from the social interaction (Stefik et al., 1986; Rønby Pedersen et al., 1993; Wiberg, 2001).

Politeness in the Educational Setting

Politeness in the studio included not looking in other students' drawers and not touching others' belongings. As one of the students said:

> You don't mess around with other's stuff. (Interaction design student)

One should also state critique in a nice way, while also being able to take critique. Other things that reflect politeness was helping someone who asked for help, respecting others' concentration, and not peeking over someone's shoulder if not invited to do so. It is important not to build computer environments that disrupt these norms.

Politeness in the Leisure Setting

Similar things could happen in front of the television. For example when someone monopolized an appliance, he or she sometimes apolo-

gized for doing so. Some testers were very keen to make sure that the others got to see or read what they thought was interesting:

> Olivia: Shall we, eh go on to something else, do you think? (3s) I mean, something else besides DN. Or is there anything here that you want to see? Especially. Search destination perhaps? ((looks at Anders. Short conversation about advertisements)) Do you want to drive for a while?
> Anders: Yeah, sure I can!

Another way that politeness was shown was that guests in the household would not take control over an application if not invited. When people sat in dyads or triads in front of the television screen surfing news they often were considerate of the others interests. Testers said things like:

> What shall we choose now? (Tester of the online news service)

> I think it's fun to see what you are interested in. (Tester of the online news service)

When playing the quiz game the informants were also being polite to each other. Here is one example:

> Heh… I moved when I didn't want to. ((laughter from both players)) (Player of the quiz game)

The player above makes a mistake with the game mechanics and makes a move against the rules. She states her mistake and hence looses positive face. The joint laughter is face-saving since it means that it is ok and that they only are playing. By laughing the other player says that she does not mind. The laughter from the one who made the mistake means that she recognizes that.

If we revisit one of the excerpts introduced under participation, we can see that the social challenge provided by the quiz game really is a play with face where the players pretend to insult the other by performing face-threatening acts.

Olof:	((reads the question aloud and answers correctly)) I got a piece! I'll just continue then. You cannot play, Kent.
Kent:	Damn, you are so tedious. ((both laughs and Kent hands over the remote control)) I'll have a cookie instead.

If anyone really should be offended by the things that are said in the joint pretence of a "battle of wits" then the other person would get offended by that, since what is being tone as part of the game should not have any causal effect on the real world (Clark, 1996).

Politeness as a Use Quality Design Objective

The participants in a sociable setting have a mutual wish to maintain each other's face in terms of autonomy, self-image and self-worth. Computers can either help or place obstacles in the way for co-present users who try to maintain the face in the situation of use. The social aspects of politeness are the most obvious ones. The instrumental aspects include if one can manoeuvre a shared interface without impeding on each other's actions, and if one can express and indicate to the other what one is interested of. That is part of expressing a self-image, which of course also relates to aesthetic aspects: the feeling of being polite or impolite and the feeling of bragging and teasing. The ethical aspects are less clear from the users' point of view but from the designers' point of view it is obvious that one would not want to build computer systems that for example force clerks to be rude to their customers. The constructional aspects are also less salient for this quality in use.

5.5. Differentiating Use Qualities

Participation, autonomy, extemporaneity and politeness are use qualities that are important to consider in all three cases, and probably in all sociable situations of use. At first sight, however, the three cases seem quite different. So what use qualities make them unique?

As shown in the previous chapter, the differences stem partly from the differences in control (Clark & Brennan, 1991; Clark, 1996) in the three settings. At the bank the participants do not determine for themselves what to do during the meeting, and the clerks do not express

only themselves but also the bank as part of their actions. In the educational setting, the students do not determine what to do. Teachers and curriculum decide that. The students do, however, express themselves in their actions. Finally, the people in the leisure setting determine for themselves what to do (with respect to the other members of the household), and they express themselves by the actions that they perform.

Differences between the three settings also stem from what the activity is about: the motives that the participants enter the activity with, and by the culture in which these activities have evolved. The main motive for the clerks at banks is to manage the customer relationship and get the customer to be a "good customer". The customer may have conflicting motives in that he or she does not want to be made money of. Instead the customer wants a good deal. In the studio the main motive is to do design and learn to design by reflection. In this situation there are usually no conflicting motives, but occasionally someone wants to work while others want to play. In the leisure setting of the living room the main motives are to spend time together, relax, and do something that one finds interesting. There may arise conflicting motives here too: what to watch on television, who is to surf on the laptop and who has to wait, talking loudly with friends or watching the game of football. The relations between the participants are also different. In the bank case they do not know each other, in the studio they are friends, and in leisure setting they are close friends or family. The rest of this chapter will briefly describe the use qualities that are specific to the three settings that have been studied.

Figure 5.1, 5.2 and 5.3 on the following pages describe the relations between the use quality design objectives that are common in the three cases, and those that are specific to each case. If the diagrams are read from left to right they explain what use quality design objectives that must be met in order to fulfil the quality objective where one started to read. For example, if one takes Politeness in Figure 5.1, Prestige, Secrecy, Correctness and Speed must be met. To achieve Speed one also needs to fulfil Simplicity and so on. If the diagrams are read from right to left they answer the question of why a quality is important. For instance, Speed is important as a means for Politeness, but is also an end in itself. One should, however, not read the diagrams as hierarchical breakdowns of every quality. There is more to

Politeness than Prestige, Secrecy, Correctness and Speed, but the subordinate use quality objectives assists in achieving the higher objectives.

Unique Use Qualities in the Professional Setting

A number of use qualities were identified as desirable for interactive systems in the bank setting. The following qualities are simplified and synthesized. Further details can also be found in Holmlid (2002).

Correctness. The results of actions performed by means of the computer systems must be correct, especially during customer meetings. It is a matter of reliability and trust. This quality is similar to the traditional usability goal of effectiveness. If the results are not correct clerks and customer will feel insecure of themselves and of their ability to use the interactive systems. This may lead to decreasing the trust from the customer in the bank and the clerk as well as loss of face in front of the customer. This use quality is a means for politeness and also an end in itself.

Speed. There are often customers waiting and therefore the clerks want to work fast. They do not want to keep their current customers waiting if it is not necessary, since that would be impolite. If the usage of the computer systems is slow it will also hamper the social interaction with the customer. This quality is related to the traditional usability goal of efficiency. This use quality is a means for politeness and also an end in itself.

Simplicity. The interactive systems and other artefacts that the clerks are using should be integrated and flexible so that the users easily can switch between them and work with them in parallel. This use quality is a means for extemporaneity and speed. It is also an end in itself.

Secrecy. The interactive systems that are used in meetings should never disclose information to the customer that the customer should not have access to, for example information about other customers. This use quality is a means for politeness and also an end in itself.

Prestige. The tools of the trade, i.e. the computer systems that a clerk uses, identify and symbolise the role of that person within the organisation and his or her group affiliation. The interactive systems should fit with the self-image of the user. This use quality is a means for politeness.

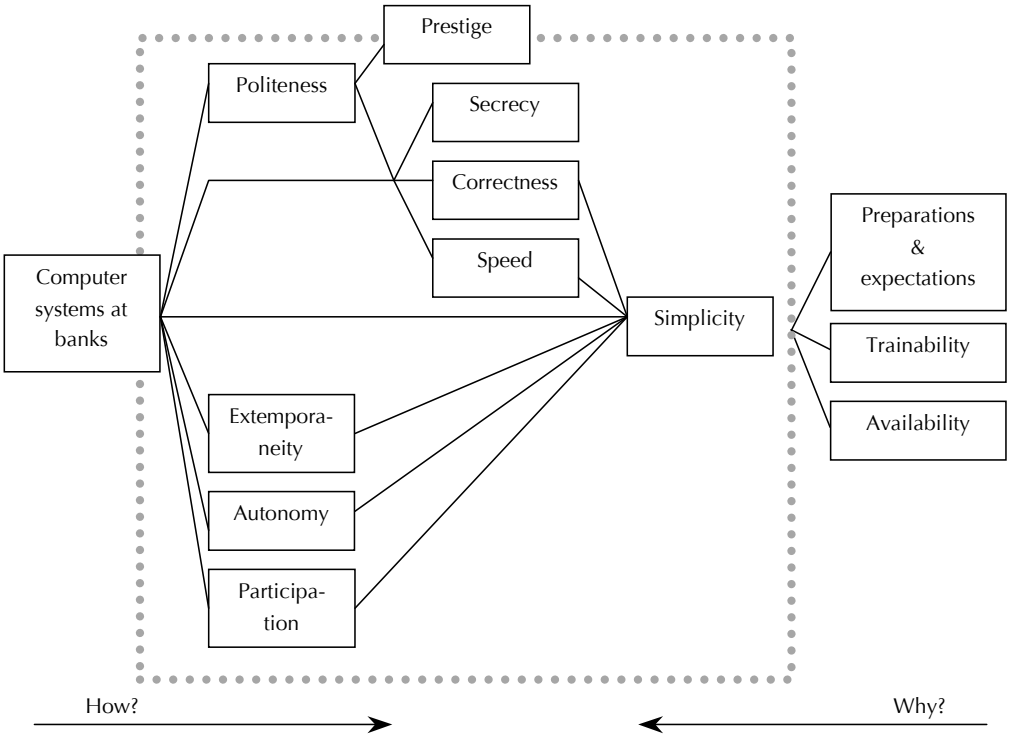

Figure 5.1: Objectives tree analysis of use qualities for a computer system to be used during customer meetings at banks.

Preparations & Expectations. Clerks need to know what to expect in order to prepare themselves and customers for what is going to happen in the meeting. Computer systems should facilitate in building these expectations. Holmlid (2002) calls this use quality ante-use. This use quality is a background quality that lays the ground for many of the other qualities.

Trainability. The trainability of using the interactive systems depends largely on managerial, organisational issues. Before introduction of a new computer system at the bank, clerks must have time and incentive to learn to use the new system. Management will need to encourage and create space for clerks to learn new tools. Trainability is a background quality that lays the ground for many of the other qualities.

Availability. Systems need to be working and be online, since clerks are dependent on them. This use quality is a basis for all higher-level qualities.

Unique Use Qualities in the Educational Setting

Several use qualities were identified as uniquely desirable for interactive systems in the studio setting. The description provided here is simplified and synthesized.

Creativity. The students are in the studio to do design and in order to do that they need to be creative. That is, explore a design space by testing many different ideas and appreciate their qualities and their value. Some ideas will be refined, some will be synthesized and other will be discarded. Any interactive system that can help them to be creative will be of good use.

Reflection. The way that the students learn is by reflecting on what they are doing. They need to reflect on the qualities that the design solutions have, on the process of designing, and hopefully also on the process of learning.

Inspiration. Students need inspiration. Sometimes that is not a problem and ideas come to their mind immediately. At other times they are dependent on feedback from other participants. Inspiration that can be synthesized with the present vision that a student may have can come from anywhere. Inspiration is a means for creativity.

Flow. The experience of flow can be quite seducing. This happens when the student is immersed in the nitty-gritty detail of design work and time seems to seize to exist. The student is then involved in a very tight loop of seeing and appreciating. Any object can enter this "conversation with the materials of a design situation" (Schön, 1992), which can be both individual and participative. This is related to the traditional usability goals of efficiency and effectiveness. Flow is a means to creativity.

Concentration. There is a need for privacy and concentration to be able to work in a creative way and in order to stop and reflect upon one's work. Concentration is just like Flow related to effectiveness. This concentration needs to be respected by the other participants in the studio as well. Concentration is a means for both creativity and reflection.

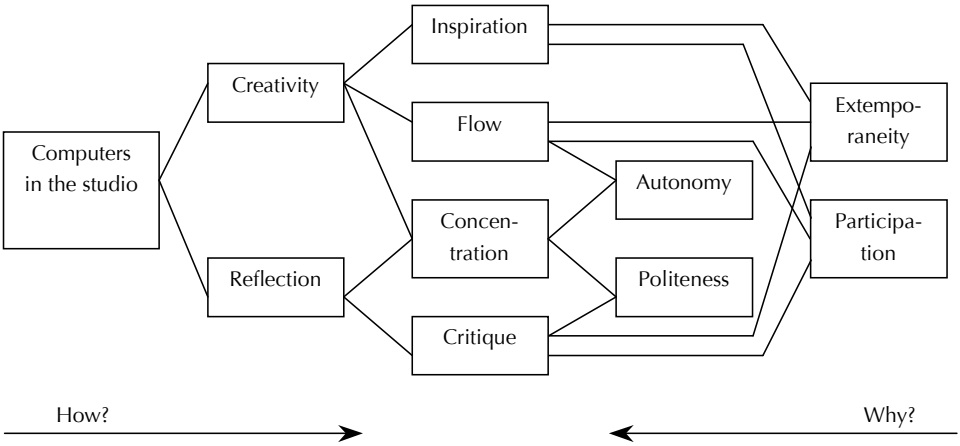

Figure 5.2: Objectives tree analysis of use qualities for a computer system to be used for learning to design in a studio.

Critique. Reflection cannot only be performed in solitude. The students need to confront their taken-for-granted perceptions and assumptions in order to learn. The students are forced to reflect when articulating and talking about their design process and design solutions and when seeing and talking about others work.

Unique Use Qualities in the Leisure Setting

A number of use qualities were recognized as uniquely desirable for interactive systems in the living room setting. The portrayal provided here is to be considered an overview.

Laidback usage. The situation of use of a multimedia home platform is laidback and relaxed both in mindset and physical posture. At its best it is free from labour, embarrassment and constraint.

Engagement. Something is engaging when it catches someone's attention and keeps it. This can happen both when an activity in itself is interesting enough to captivate the participants, and when the content of a media (e.g. movie, book, news) is interesting enough.

Togetherness. Togetherness is the state of being together in a group, being in simultaneous contact and doing things by combined action. An interactive system can promote both immediate together-

ness and delayed togetherness, as described under Participation in the leisure setting earlier in this chapter. Togetherness is an important use quality design objective as also noted by Hindus et al. (2001); spending time with one's family is what counts as quality time in a home situation.

Safety. The feeling of safety is another basic need just like togetherness. It is generally provided by the familiar surroundings of ones home and by closeness to family members and friends who one always can depend on. Technology can contribute to this by setting safety for oneself and one's family as a design objective. Technology can also provide communication channels between family members, friends and relatives.

Style. When a new object is introduced into a home the residents consider where it would fit in terms of not only instrumental function but also style. If the residents do not think it fits anywhere but still want the functionality it provides they will most likely hide it in a cupboard or a drawer.

Comfort. When people sit down on the living room couch they want to feel comfortable. That is, they want to feel content in an enjoyable experience without trouble. This quality is a means for laidback usage.

Effortlessness. Besides from feeling comfortable they also desire things to go smoothly without any perceivable friction and effort. This is related to the usability goal of efficiency, but not in terms of time but rather in terms of effort. An interactive system will not be used if people experience too much friction when using it since they do things at their own discretion in their leisure time. This quality is a means for laidback usage.

Effectiveness. Obviously people do want to reach the individual and shared goals that they may have for using a particular interactive system. If they don not reach them and get a good enough result the system is practically useless. This quality is a means for laidback usage.

Challenge. A challenge is when something is hard enough to achieve. It is not a challenge if it is routine and if it does not take skill to perform it, and it is not a challenge if it is impossible to do it. Challenge is therefore a balance between skill and level of difficulty. This quality is a means for engagement.

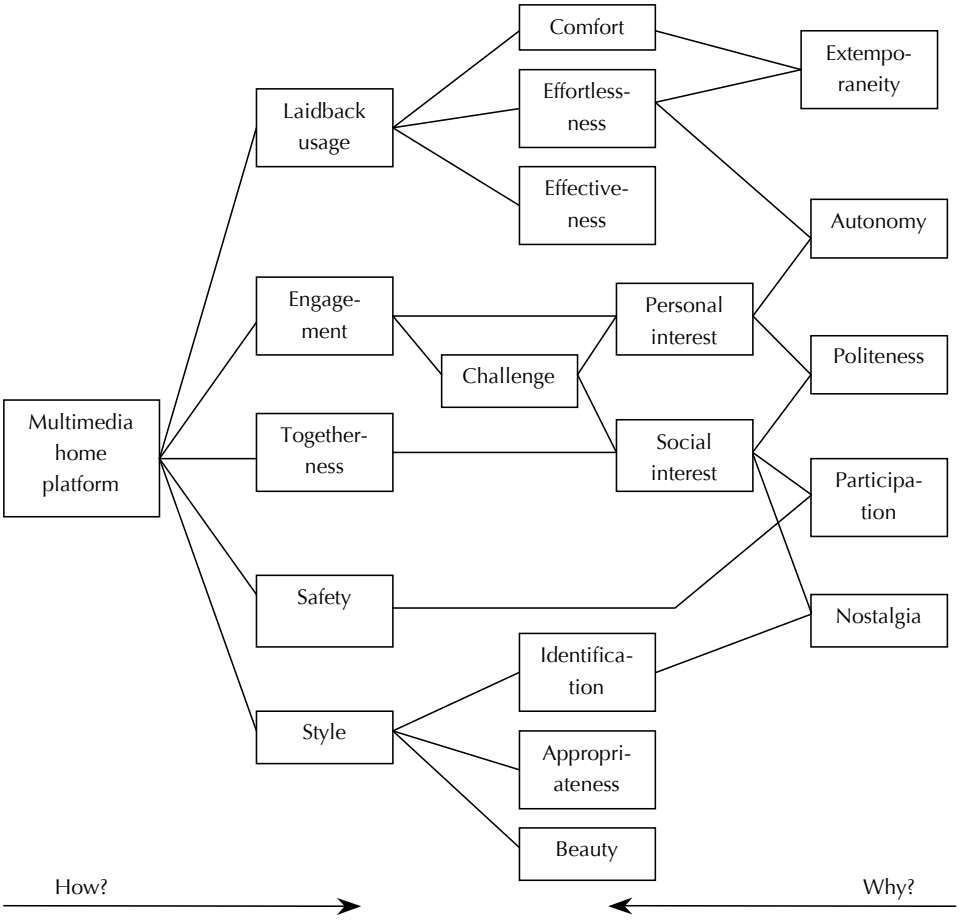

Figure 5.3: Objectives tree analysis of use qualities for a multimedia home platform.

Personal interest. A personal interest is something that an individual finds interesting as a topic or as an activity. It provides personal challenge when seen as a means for challenge. Personal challenge is a challenge for one's personal skills and abilities, either mental or physical. This quality is a means for both challenge and engagement.

Social interest. A social interest is something that interests several people in a group as a topic or an activity and, therefore, the other

participants are more in focus than for the personal interest. This quality is a means for both challenge and engagement. When a challenge is social the participants compete with each other or they may play with the social norms and value systems as shown in the quiz game trials.

Identification. People identify and differentiate themselves by means of the things that they own. Informants regularly talked about themselves in terms of the kind of people who does this or that or the kind of people who has this or that. Identification is a means for style.

Appropriateness. When users of technology try to fit their objects into their homes they consider where it is appropriate to have them and when to use them. A personal computer is often seen as bulky and impossible to place anywhere except for the study. It may not be equally appropriate to have it and use it in the kitchen or during dinner. A laptop is easier to place, and some technologies have their obvious place like the television or the stereo set, but still even those rather domesticated technologies can be difficult to place in a home. Appropriateness is a means to style.

Beauty. People will also enjoy using things that please their eye and their other senses. Parts of what they will perceive as beautiful has to do with subjective taste, other things have to do with what other people within the same social group think is beautiful. Yet other things are objective in that they are pleasing to people in general. This quality is a means to style.

Nostalgia. People experience nostalgic feelings towards things in their home since they are filled with memories of people events that are meaningful to oneself and to the family. Nostalgia is a means to identification.

5.6. Characters in Sociable Use

This chapter has so far dealt with specific qualities of systems in sociable use. For the remainder of this chapter the attention is turned to more holistic descriptions of how the systems should behave: its character in use.

A common character in all three settings was that of *the application as a tool*. The interaction with the application was in focus, and the interaction between people became secondary. In the leisure case that meant that the person who did not have the remote control lost inter-

est. In the interaction design studio students often worked by themselves and the applications were then in tool usage. The system as a tool was also a character that appeared at the bank. During the extensive time spans of data input into the system, or when there was a breakdown, the clerk could not attend the customer. The customer then started to look into the roof and the clerk excused him or herself for ignoring the customer, in order to help the customer regain face. The computer was then objectified and thereby entered as a topic into the conversation. When the computer is used as a tool during the meeting, the customer becomes a distraction for the adviser. This is a problem when the use of the computer is in this character for too long. The application as tool is for this reason the least wanted character during a customer meeting.

During the customer meeting, the most preferred character is instead *the application as a resource*, which is a variant of the tool. The social interaction is in focus when using an application as a resource, while the software interaction is secondary. For the tool it is the other way around. When an application is a resource rather than a tool, the clerk can attend to the customer rather than the system. A resource is only backing up the user in his or her main work. In this case the main work is to listen to the customer, in order to end the meeting with a signature on a contract.

Another character that was observed in all three settings was a variant of the medium: *the application as a common resource*. When an application is a common resource, the interplay between the participants is in focus while the application feeds that interaction. The difference between a common resource and a medium is that the former inputs something to a dialogue, while the latter mediates or acts as an intermediary in a dialogue. Just as with the resource, it is the social interaction that is in focus, but in contrast to the resource the common resource is available and controlled by all participants and not only by one. They are also using it with joint or overlapping motives. At the bank, the printouts from the systems worked as common resources and occasionally the clerks turned their screens towards the customer in order to explain or show something. In the interaction design studio students often showed something to another student in order to get comments. They view it, point, and discuss in order to coordinate their work and give feedback. During critique and focus sessions they

sat together using a projector to show a prototype. They also made printouts and sat by the shared table to sketch and discuss. During all these episodes the applications were used as common resources. When testers of the multimedia home platform played a game on the television screen or when they surfed news together, the applications were used also as common resources for conversations and the content of the applications fed the dialogue with topics. This is also an example of the application as a common resource.

While remaining within one character, an application sometimes changed mood of control. Applications could sometimes be in *turn-taking control*; one of the participants controlled the interaction at one time but could later on turn over the control to another participant. Sometimes that individual asked for the control and at other times the control-owner simply turned it over. If the joint use of an application continued for some time a practice of turn-taking usually developed. This was particularly clear in the case of interactive television where there usually is only one remote control. This only happened with printouts from applications at the bank, and not with the applications themselves, due to the expert-client relationship. In the interaction design studio, applications could be in turn-taking use when two students sat together in front of one screen. At some times, especially when applications and printouts were used as common resources they were also seen to be in *parallel control* by all users. More commonly they were 'backseat driven' in *mediated control*; other participants told the control-owner what to do. Sometimes the clerks turned the screen towards the customer to show something or explain. The clerk then distributed control to the customer, and invited him or her to be a backseat driver while the clerk took on a supporting role. That meant that a number of design considerations of bank secrecy and the tension between private and public became important. Occasionally in the interaction design studio, a student stood behind another student while he or she was working, and commented on what the primary user was doing. Sometimes the bystander told the primary user what to do. For instance: "What if you write it like this…" The application is then used as a tool with mediated control, or backseat driving. For testers of interactive television backseat driving was also common. For example, one tester told the other what news article to choose.

Another character that was noticed was the character of the machine. For instance, on clerk used the old B-menu instead of the new SYNK system since he did not trust it after that time all Volvo deals had become Vostok deals. This is an example of how the interactive system was seen as complex and strange and the user was no longer in control.

Occasionally the clerks at the bank saw their usage as part of a regulated and controlled system as in the following example:

> She checks that all documents are included. Will print out mortgage deed. Goes in to ASK Overview. Customer info, cleans info by means of a button, minimizes, restores. "The difficulty is to know the system," she says. They have two checklists, so that everything is included.

Another example from the bank that also illustrates the feeling of being a controlled part of a system:

> I logged in four times and had two views in the subsidiary mortgage institute. They don't communicate fully: our systems and theirs. It's cumbersome to change between them. The security views can look quite messy. Sometimes it's 15–16 rows for describing pledge. The system does not help and if there is an error you need to start again from the beginning! I, as a banker [with 30 years of experience], can see that they should have the loan, but it's the scoring system that controls it. It is sometimes an obstacle even though I understand why it exists. (Clerk at the bank)

Applications were often used in many different ways. The characters were not stable. The multimedia home platforms sometimes changed rapidly from being a medium with content in focus, to a common resource that fed the social interaction of the testers and was used with equal control. In addition, people in front of an iTV-appliance will enter and leave the activity (for example to make coffee), and the subgoals of the activity may vary as the activity goes on. The multimedia home platform could also be a tool for carrying out an action without concern of others. They were switching between turn-taking control, parallel control (when that was made possible by means of two remote controls), and mediated use. At the bank, applications were seen to switch between common resource, resource, and tool. A

clerk talked to a client using the application as a resource by glancing at some figures, and only moments later it was a tool for entering information. When the clerk turned the screen or made printouts it became a common resource. In the studio, students worked with their applications in many different ways in a pattern similar to the bank clerks' usage.

The field studies show that there are variants of the medium and the tool, which play a role in sociable use of applications. It is different to use a system while being co-located with others, and to use a system in solitude. The field studies also showed that the shared control over an application could change between different users in three different ways: turn-taking control, parallel control, and mediated control.

The systems studied in these settings did, however, not support very fluent and swift changes between different characters and different moods of control. It was cumbersome for users to use a system in different ways. A number of workarounds and insufficient strategies were used: printouts, turning screens with the risk of exposing things, using a system as tool and ignoring other people, and so on.

5.7. In Summary

The empirical work in the case settings has shown that people who are co-present in a situation of use engage in joint activities and participation is therefore an important use quality of interactive systems that are used in such settings. The participants also have private agendas and individual activities that they want to perform unimpeded and autonomy is therefore also an important use quality. Whenever people meet in dialogue the outcome is somewhat unpredictable and spontaneous. Acts are unexpectedly performed on the spur of the moment and extemporaneity is therefore an important use quality of interactive systems in sociable situations. In addition, participants in a sociable setting have a mutual wish to maintain each other's face and politeness is hence an important use quality.

Participation, autonomy, extemporaneity and politeness are use qualities that are important to consider in sociable situations of use. There are, however, also many differences between the three settings that were studied. At the bank, the participants do not decide for themselves what to do and the clerk expresses the bank as well as him- or herself through the actions that are performed. In the studio, the

participants express themselves but they do not have control over what to do. In the living room of their home the participants decide what to do and they express nobody else but themselves. Another reason for the differences is that the activities are about different things. The clerks' main motive is to manage the customer relationship, while the students' motives are to design and learn to design while enjoying the company of their fellow students. In the home, people want to relax, enjoy each other's company and be engaged in something meaningful to them.

The interactive systems that were used in the three settings were used as tools, resources and common resources. Occasionally they were seen as machines or systems. They were also used with different moods of control: turn-taking control, parallel control, and mediated control. The system as a common resource and the system as a resource can be seen as variations of media and tools respectively. The systems studied here did not support fluent changes in character. It was cumbersome for users to use a system in different ways. A number of workarounds and insufficient strategies were used: for example printouts, turning screens with the risk of exposing things, using a system as tool and ignoring other people.

This chapter has shown how complex sociable situations of use can be approached from many different perspectives revealing manifold shades of use.

6. Design Patterns

This chapter describes what design solutions that have the potential to provide the desirable characteristics for interactive systems in sociable situations of use. The analysis of field notes from the three case settings revealed four use qualities as desirable for all three settings: participation, autonomy, extemporaneity and politeness. Conflicts between the qualities were also identified, and this formed the basis for the forces and the problem statements in the following design patterns. The solution statements are based on analysis of situations where the forces are not in conflict, trying to find some feature that resolves the potential conflict. This chapter describes patterns that can be used to figure out the interaction design of computers that will be used in situations where several people are co-present. An example of a system derived from the patterns is also presented.

Design patterns describe a recurring problem, its context, the forces in the situation and a generic solution to the problem. The feature that solves the problem is written in a generic but concrete way, so that it can be designed in an infinite number of ways, while still being readily identifiable. Anyone should be able to see if a design solution has a particular feature or not. (Alexander et al., 1977)

Every pattern can be seen as a working hypothesis; they represent the current understanding of what the best arrangement is for solving

a particular problem. For this reason, it is important that the pattern is clear, sharable, and debatable. Alexander and his team used an asterisk after the pattern name to indicate the degree of faith they had in the pattern. No asterisk meant that it was a tentative formulation of a pattern; one asterisk was that it was fairly stable; and two asterisks meant that it was very well supported.

Within HCI and interaction design, a number of different formats for writing patterns have been suggested (e.g. Granlund & Lafrenière, 1999; Tidwell; 1999; Erickson, 2000; Martin et al., 2001, 2002, Walldius, 2001), but I have chosen, as Junestrand et al. (2001), to present the pattern in Alexander's original style of writing, since his patterns are more vibrant, more alive, and more concrete than other patterns. This means that every pattern is formatted in the following way (Table 6.1):

Concept	Form	Description
Title	Pattern no., Text and 0–2 asterisks	Indicates the design solution of the pattern. The asterisks indicate the validity of the pattern, two at most.
Picture	Photo or illustration	An impressionistic example of a pattern.
Introduction	**. . .** Text	The context for the pattern by mans of links to higher-level patterns. Starts with three dots.
Diamonds	◊ ◊ ◊	Marks the beginning of the problem.
Headline	Bold text	The essence of the problem a few sentences.
Body of problem	Text and illustrations	The empirical background to the pattern describing the forces in conflict in the problem. The evidence for its validity, the range of manifestations and so on.
Solution	Text in bold type	The field of physical and social relationships, which are required to solve the stated problem in the stated context. The solution is stated in the form of an instruction so that you know exactly what you need to do to build the pattern.
Diagram	Drawing and text	The solution, in the form of a diagram with labels that indicate its main components.
Diamonds	◊ ◊ ◊	Three diamonds to show the main body of the pattern is finished.
Connections	Text **. . . .**	Connections from the pattern to the lower level patterns that are needed to complete this pattern. Ends with four dots.

Table 6.1: The form and structure of an Alexandrian design pattern (the table is adapted from Junestrand et al. 2001, p. 756).

This is the structure that the patterns presented in this chapter will follow. The impressionistic photo that sometimes begins the pattern is, however, not included.

The patterns presented in this chapter are at three levels. Firstly, REGULATING PROMINENCE is an activity pattern, describing activities of people in sociable situations (also described in Arvola & Larsson (2004)). Secondly, COMBINATIONS OF MOBILE AND STATIONARY DEVICES is an artefact pattern, describing how to choose technological platforms to create spaces for action where users can obtain REGULATING PROMINENCE. Thirdly, DROP CONNECTOR, GO CONNECTOR and SEND CONNECTOR are user interface patterns describing how to allow users to seamlessly move information objects between devices in order to regulate prominence.

6.1. Five Design Patterns for Controlling Information Visibility

P1: REGULATING PROMINENCE *

. . . people engaged in COLLABORATION IN SMALL GROUPS (Martin et al., 2002) work jointly, but also individually. It is therefore important for users of technology in such situations to be able to control their objects of work and fluently move them between private and public states, including gradations between (Greenberg, Boyle & LaBerge, 1999), but so far no pattern has shown how to do so. This pattern can be used to figure out the digital details of work places provided by Alexander et al. (1977) in INTIMACY GRADIENT (127), SMALL WORK GROUPS (148), HALF-PRIVATE OFfiCE (152), and ALCOVES (179). The pattern also complements the PRIVATE AND PUBLIC DIGITAL SPACES (127b) (Junestrand et al., 2001).

◊ ◊ ◊

Hindering people to do things individually while participating in collaboration or excluding them from the joint activity can be quite impolite. In addition, it is rather difficult to foresee what objects participants will use for individual actions and what objects they will use for joint actions. Therefore, people need to be able to move objects between private states and public states, including gradations between, but this is cumbersome to do with information objects confined to traditional PC-based workstation.

Users of personal technologies often meet and co-use their devices (Weilenmann, 2001), and occasionally there is some form of public display available that can be used for joint motives (such as a television screen or a monitor swivelled towards a customer). Collaboration would be of better quality if users could then easily move information objects between their personal technologies as well as to the public screen and back again. In the home, all devices such as stereos, televisions, PCs, tablet computers, etc. could be interconnected, and whenever a conflict between personal interests arises the information object could be moved to another device. Consider a scenario where someone wants to watch a show on the television screen while someone else is in the living room listening to music, the music could be moved to the stereo in the bedroom and the other person could go there and listen instead, or perhaps they, by a simple operation, could move it to the personal handheld music device instead. Alternatively, if someone watches a movie on a small screen in a bedroom it could easily be moved to the large screen in the living room if anyone else also wants to watch. Four forces in this situation (participation, autonomy, extemporaneity and politeness) are described below.

Participation. People who are co-present in a situation of use have some projects that they do together. Sometimes the projects are small, like a greeting for instance, and sometimes they are bigger, like watching television together. These projects have joint goals, shared objects and shared representations. In order to work on these shared objects, participants need to establish common ground and to maintain coordination (Clark & Brennan, 1991). This means that they have a shared view on what they mean by different terms, what they want to achieve and how to achieve it. For that to work, they need to devote some of their attention to the other participants and what they do. The feeling of participation is also important for the individual participants and a strong incentive to participate.

Autonomy. Participants in the sociable setting have private agendas and activities as well as joint goals and activities. They want to perform autonomous actions unimpeded. Individual work is performed in parallel with joint work and it is either stemming from a personal interest, from using objects as tools for one's own mind, or from private agendas.

Extemporaneity. Whenever people meet in dialogue the outcome is somewhat unpredictable and spontaneous (Clark, 1996). What previously was private may therefore, in a serendipitous interaction suddenly be needed for joint actions. Since individual and joint activities run in parallel and feed into each other an impulse that change the activity can come from any direction or source.

Politeness. The participants in a sociable setting have a mutual wish to maintain each other's face (Goffman, 1967; Brown & Levinson, 1987). Every participant has a claim to autonomy, and do not want his or her individual actions to be impeded by others. The co-participants recognize this autonomy and do not want to hinder it. They also respect and want respect for their self-image and self-worth. Not doing so would be impolite and face threatening.

Summing up. People do things autonomously while participating in collaboration. They also think about others while performing individual actions. Some of these are publicly displayed so that other participants can monitor the actions peripherally and through that create an awareness of what is going on. Hindering people to do their own things or shutting them out from a joint activity can be impolite. It is quite difficult to foresee what objects participants will use for individual actions and what objects they will use for

joint actions because of the extemporaneity of face-to-face conversation.

In everyday life, our focus is constantly shifting between different objects while other objects are kept in the background. When working on physical objects it is easy to manage the shifts by for instance moving a piece of paper 20 cm or by swivelling our chair (Luff, Heath & Greatbatch, 1992). Managing a constantly shifting focus in the stream of everyday activities is hard to do on virtual information objects with our current technology, since they are confined to a rather small, stationary and inflexible physical surface.

Therefore:

As shown in Figure 6.1, provide participants with a platform where they can work in parallel on private information objects that are prominent only to them and also work together on joint objects that are prominent to others. Create a mechanism for easily making objects more and less prominent for oneself as well as for every other participant so that an object can be prominent for one person while peripheral to others.

◊ ◊ ◊

It is likely that it takes several screens for the participants to run personal activities in parallel, using COMBINATIONS OF MOBILE AND STATIONARY DEVICES. If privacy is not necessary then a single big shared screen might work, but it would have to have a shared area where all participants can work jointly on a prominent PUBLIC ARTIFACT (Martin et al., 2002), as well as a shared area where they can work individually on objects that are prominent to them but peripheral to others, as with an ARTIFACT AS AUDIT TRAIL (Martin et al. 2002).

Such a division of the large screen can be made using TILED WORKING SURFACES (Tidwell, 1999). A personally oriented surface on an otherwise shared screen would have to be hidden, for example behind tabs or a "hide-button" utilizing a STACK OF WORKING SURFACES (Tidwell, 1999), but that would not be a very elegant solution since a user have to turn the screen away, or ask the others to look away, in order to access that surface privately. This can be perceived as impolite to other participants **. . . .**

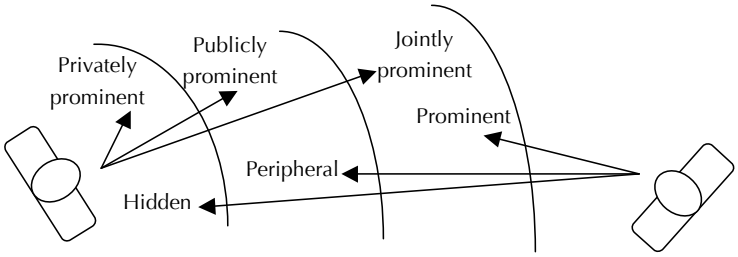

Figure 6.1: REGULATING PROMINENCE from the perspective of the left participant.

P2: COMBINATIONS OF MOBILE AND STATIONARY DEVICES

. . . this pattern helps to organize spaces of action so that a PUBLIC ARTIFACT (Martin et al., 2002) works together with personal devices. This is a way to help users REGULATING PROMINENCE and hence move seamlessly between the private and the public including gradations between.

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Co-present users need to run personally oriented activities in parallel, while still making the objects of their concern available to others without occupying their whole attention if they do not want to. A good computer platform for sociable usage strikes a balance between spaces for personally oriented action, shared space for joint action and availability of objects of the user's concern.

A region (a functional space) for joint activities must presume a shared space where several individuals together can do the things that they want to do together. However, every region discloses itself for each individual and gives an individual perspective within the space. This individual perspective gives a particular predisposition to how each person can act. As Arisaka (1995, p.467) notes when explaining Heidegger's theory of space:

> "The particular configuration of one's personally oriented space is for that individual in that particular place alone, but it is dictated by a given region"

Three qualities are competing in this pattern: Personally oriented space of action, shared space of action and availability.

Personally oriented space of action. Individuals orient themselves towards the objects of their concern. These are kept physically near and within attention. The personally oriented space of action is perspectivally unique to that individual and he or she has configured the space to fit the present concerns and the things that he or she cares about. For example, the clerk in a customer meeting at the bank view, use and orient towards the table and the things on it differently than the customer does.

Shared space of action. People who are present in the same region share space of action. The region is defined by the activities that take place there and the resources for those activities are aligned to that. The co-present people can refer to objects around them and hence bring them into each other's presence.

Availability. People create their personally oriented space of action by bringing objects of their concern into presence. As noted above, they do not only create the personally oriented space, they also create the others' personally oriented spaces. When they share space of action these objects can be indexically referred to or signalled to others within the space, and then they are made available to others within the same space. It can also be "pushed closer" to others and hence made more available and more prominent to them. Within the shared region one can offer the other to bring something closer to them. For instance, as the clerk tries to make sense of some figure he or she can invite the customer to share the information.

Co-present users of interactive systems need a shared space of actions and a personally oriented space of action, and they also need to be able to make objects available in their own and in others personally oriented spaces of action.

Therefore:

As shown in Figure 6.2, use multiple devices that can be either personally oriented or regionally shared. One should always be shared for joint work. Stationary displays make good shared displays given that they are placed so that they are available to all participants. The users who are active should also have a device that is personally oriented which they can organize so it fits the things that they care about. Use devices that are mobile as personal displays so participants can tilt it and show the others what he or she is doing without completely occupying their attention. Inactive users do not need a device of their own. Connect the devices in a peer-to-peer network and allow users to move objects seamlessly. Consider implementing an ad-hoc network where wireless devices that users carry with them can be integrated into the network as they come into range.

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Some user interface interaction techniques are needed to provide the functionality of moving objects seamlessly between the devices in the peer-to-peer network. DROP CONNECTOR, GO CONNECTOR or SEND CONNECTOR can present that functionality to users, but the pick-and-drop technique developed by Rekimoto (1998) can also be useful when users are at arms length from each other and from the stationary public device . . . .

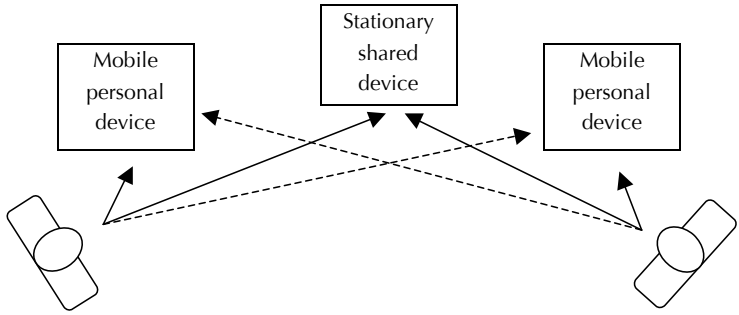

Figure 6.2: COMBINATIONS OF MOBILE AND STATIONARY DEVICES where users have direct access to their personally oriented devices and the shared device, while only having access to others personally oriented devices when invited.

P3: DROP CONNECTOR

. . . within a peer-to-peer network—for example COMBINATIONS OF MOBILE AND STATIONARY DEVICES—users sometimes need to move objects between nodes in that network. This user interface pattern can be used when the device, through which the user acts, has a screen of reasonable resolution and size and where they can make use of drag and drop.

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When users need to move information objects between devices they need to do so swiftly and seamlessly. In addition, devices have different operating systems but still need to communicate.

Swiftness. Users need to move objects swiftly in order to make use of it serendipitously and extemporaneously.

Seamlessness. Users need to move objects without perceptual seams. It should not be an activity in its own to move an object.

Personally oriented space of action: User may use very different devices within the peer-to-peer network.

Platform independence. Devices in a peer-to-peer network may have different operating systems.

Take instant messengers for example. Users often use these peer-to-peer networks to transfer files and links to each other. The same program exists on several operating systems and several different kinds of clients can be on the same network. It is, however, common that a user on one kind of a platform cannot transfer files to users on other platforms. He or she then instead has to send it by email or upload it to a public website in order to share it. This is a source of great frustration.

Therefore:

As shown in Figure 6.3, make a drop connector where users can drag and drop information objects to graphical representations of the other devices at which it appears on the displays of the chosen device. Make a component for the graphical interface that is separated from the distributed event manager and also separated from the operating system, so that it can be easily ported to other clients located on other types of devices.

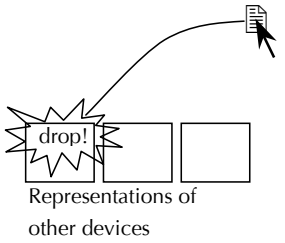

Figure 6.3: DROP CONNECTOR where a user drags an information object and drops it on some graphical representations of the other devices in the network.

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In order to realize this pattern, the platform must be able handle drag and drop events. Make sure that the drop area representing the other devices are easy to hit when dragging an object to it. Consider highlighting it when the mouse enters the area using ROLLOVER EFFECTS (Tidwell, 2004) so that a user immediately recognizes that the mouse is over that specific drop area. Provide feedback on the progress of the transfer of objects, using PROGRESS INDICATOR (Tidwell, 2004) or PROGRESS (van Welie, 2004) **. . . .**

P4: GO CONNECTOR

. . . users need to move objects of their concern between different devices and between different kinds of devices depending on the current motives in their activity, as for example in COMBINATIONS OF MOBILE AND STATIONARY DEVICES. One can then provide them with gates between devices so that they can surf around on them freely. This presupposes, however, that there are no issues of privacy between the users of the different devices. The go connector is a way to navigate in NAVIGABLE SPACES (Tidwell, 1999).

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Users may want to explore what there is on other devices while also being able to move objects between devices. The driving forces behind this are curiosity and seamlessness.

Curiosity. A driving force behind all human activities and especially playful activities is curiosity and exploration. One of Millar's (1968) categories of play includes investigating and exploring the environment, manipulating and experimenting with objects for its own sake.

Engagement: Another driving force is engagement in the activity so that one enters a flow state (Csikszentmihalyi, 1990). In a state of flow the actions that one performs and one's awareness merges as one concentrate on the activity alone to the extent that one looses self-consciousness and the sense of time can stretch or shrink. (The clear feedback of moving between devices is one prerequisite that can engage users.)

Seamlessness. Users should be able move objects without perceptual seams. It should not be one activity on one device and another on another device. There should be no seems between devices.

Several screens connected to one PC can be seen implementing this seamlessness when a user moves the cursor to the border of one screen the point appears immediately on the other screen. But there is no curiosity in that example since one probably knows what to find on the other screen.

Therefore:

As shown in Figure 6.4, make a go connector by establishing gates between devices, that users can move through and also carry objects through the gates. This means that every device can have one or more screens that the user can surf to. A screen is hence treated as an abstract object that can be shown on the display of any device. Make the movement through the gates direct and engaging by providing immediate feedback that augment the sense of movement.

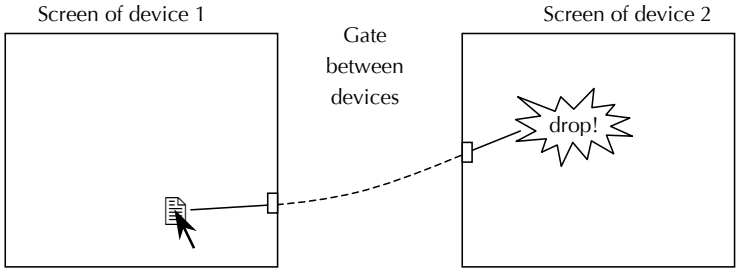

Figure 6.4: GO CONNECTOR where a user can bring along objects as they surf around on the screens of other devices.

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To realize this pattern there must be some means of carrying objects as the player moves through the screens of devices in the network. Drag and drop is one such means but other ways are possible as for example in games where the game character has equipment that can be picked up and dropped. As in any system that utilizes NAVIGABLE SPACES consider MAP OF NAVIGABLE SPACES, GO BACK ONE STEP, and GO BACK TO A SAFE PLACE. Mark out the gates as CLEAR ENTRY POINTS and to make them more salient consider using POINTER SHOWS AFFORDANCE, and to give additional information about where a gate leads one can use SHORT DESCRIPTION. Consider also using TILED WORKING SURFACES where each surface shows the other screens in a decreased size. If this design pattern seems appropriate to use in a project but difficult to implement because of issues of privacy, consider a separation of public and private areas on the devices. All named patterns in this paragraph are written by Tidwell (1999) . . . .

P5: SEND CONNECTOR

. . . Users sometimes need to move objects between nodes in that network as for example in COMBINATIONS OF MOBILE AND STATIONARY DEVICES. This user interface pattern can be used when there is limited screen estate available or if it is difficult to use drag and drop, but it is worth the effort of more programming close to the operating system.

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Users need a fast and seamless way of moving an information object from one device to another, but there can be limited screen space and risk of cluttering the screen.

Swiftness. Users need to move objects swiftly in order to make use of it serendipitously and extemporaneously.

Seamlessness. Users need to move objects without perceptual seams. It should not be an activity in its own to move an object.

Screen estate. Since users may use any kind of device in the network there can be limited screen space available.

Therefore:

As shown in Figure 6.5, make a send connector where a user can select and object and apply a function to that object that sends it away to another device of choice.

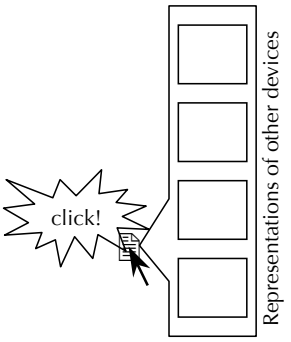

Figure 6.4: SEND CONNECTOR where some action is applied on an object after which the user can choose another device to send the object to.

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Consider using LOCALIZED OBJECT ACTIONS (Tidwell, 1999) , for example a CONTEXTUAL MENU (van Welie, 2004) to place actions nearby an object . . . .

6.2. A Design Derived from the Patterns

REGULATING PROMINENCE and COMBINATIONS OF MOBILE AND STATIONARY DEVICES can be realized in many different ways, but I wish to illustrate one way it can be implemented in a design. The LOCOMOTION system is a multimedia home platform based on the following patterns:

COLLABORATION IN SMALL GROUPS (Martin et al., 2002)
REGULATING PROMINENCE
PUBLIC ARTIFACT (Martin et al., 2002)
COMBINATIONS OF MOBILE AND STATIONARY DEVICES
DROP CONNECTOR

LOCOMOTION is based on two interconnected tablet computers and a PC with a large plasma screen, but other devices like mobile phones, handheld computers, personal video recorders and home-PCs can easily be integrated into the network. Users can move objects between the displays by a simple drag and drop. A user can tilt the tablet and make it peripherally public to the other in order not to not interrupt the others activities. An object can be dropped on the drop-area for the plasma screen if a user wants to make an object prominent to the other. If one would want to make it really prominent to the other and also interrupt the others activity one can drop it on the other's tablet. Finally, if a user want to keep something hidden, the tablet can be tilted so that others cannot see the screen (see Figure 6.5).

Figure 6.5: The current version of LOCOMOTION consists of two tablet computers and a PC with a plasma screen connected over the network.

LOCOMOTION is a distributed system consisting of two major subcomponents; (1) a distributed event manager that allows system events to be transferred between devices over the network, and (2) a graphical system for representing the different devices connected together. It is built as a peer-to-peer system with no central server and this makes it easily adaptable to an ad-hoc network. It is implemented using the JAVA programming language, and the event manager uses a small protocol on top of TCP/IP. This approach allows the system to be language-independent in the graphical system, which in turn means that it is open to additional clients located on other types of device,

such as PDA's or cell phones that don't have support for JAVA or high-level protocols.

As shown in Figure 6.6 the DROP CONNECTOR was chosen on the interface level because of how easy it is to program and how easy it is to adapt it to other platforms. There were also privacy issues at which the GO CONNECTOR was not suitable. The SEND CONNECTOR was too operating system dependent for LOCOMOTION.

Figure 6.6: The user interface for LOCOMOTION with a drop connector in the form of a floater that can be docked and auto-hidden.

Locomotion as a Platform for Convivial Computer Games

LOCOMOTION can be set up in many different forms using many different kinds of devices. One version is the platform for convivial computer games. In terms of gaming platforms, the problem with the earlier prototype systems (the quiz game and the online news service) was that neither of them could match up a traditional tabletop board game when it comes to social play. There were three reasons for that.

Firstly, as previously noted, it takes an effort to look at the others' faces when you are seated four metres away from your focus of attention and sitting side-by-side to the other players. This means that you cannot see the small cues in facial expressions and posture that are important for verbal and political conflict and hence social challenge. What is the meaning of poker face when you cannot see the other players' faces?

Secondly, as also noted before, when one person is interacting with the system the others get bored and go out to the kitchen instead, for instance. In order to keep people interested in a game they must be in the loop all the time, interacting either with the game itself or with each other. Another remote control in online news service was intro-

duced to solve this problem, but it led to interference between the users individual actions and personal interests. They had to place extensive effort on coordination.

Thirdly and related to the previous reason, when using the television screen as the only output channel there is no room for games of imperfect information where some information is kept from opponents, for example the cards on your hand in Poker.

Christopher Alexander suggested a solution to the problem in connection to the architecture of living rooms. Of course he did not foresee the penetration of computers and video games in the home when he wrote the design pattern ALCOVES, but despite that he is right on target (Alexander et al., 1977, p. 829):

> No homogenous room, of homogenous height, can serve a group of people well. To give a group a chance to be together, as a group, a room must also give them the chance to be alone, in one's and two's in the same space.
>
> This problem is felt most acutely in the common rooms of a house—the kitchen, the family room, the living room. In fact, it is so critical there, that the house can drive the family apart when it remains unsolved. […] …each [member] of the family has his private interests: sewing, reading, homework, carpentry, model-building, games. In many houses, these interests force people to go off to their own rooms, away from the family.

Alexander continues to pinpoint the problem by stating that the interests of one person easily can be disturbed by what the others are doing. This is exactly what happens when one makes the television screen highly interactive. The private interests of one person make it impossible for the other to pursue his or her private interests while being together in the couch or even in the same room. People need to be able to be together in a public space while doing their own things. Only introducing interactivity to a television screen is a bad design, since it enforces strict WYSIWIS—what you see is what I see—and in doing so also enforces tight coordination without room for parallel individual actions and imperfect, hidden private information. Alexander's solution to the problem in architecture is building alcoves at the edge the living room. These alcoves create room for personal activities

Figure 6.7: The convivial computer game setup of LOCOMOTION *where a tablet computer is used as an active game board and handheld computers are used for hidden information.*

but they are still open to the rest of the common room so that the family can be together as part of a larger public activity. The analogue solution for future multimedia home platforms is of course the pattern COMBINATIONS OF MOBILE AND STATIONARY DEVICES, which LOCOMOTION implement.

The convivial game platform setup of the LOCOMOTION system is based on two handheld computers and a tablet computer instead of two tablets and a plasma screen (see Figure 6.7). Just like the ordinary setup of Locomotion, this version allows users to work individually on information objects that are completely hidden and private, move them to a shared and public state and back again. This feature can provide a socially interesting challenge by means of imperfect information. Salen and Zimmerman writes (2004, p. 205):

> Games of imperfect information add an element of mystery and uncertainty to the game. Imperfect information invites treachery, trickery, and deception, and can be used as a design element in games meant to inspire mistrust among players.

A tablet computer that lies on the table rather than a plasma screen as the centrally placed public screen mean that players can attend each other more easily, as well as attending their private information and also keeping an eye on the information objects that are shared. The public screen can be used as a shared record and point of reference, just as the board in a board game. This feature does not interrupt social interest and makes it easier to build games that rely on verbal, and political conflict (Crawford, 2003). Since they have their own space for interaction on the tablets they do not have to wait while other players occupy the game. They can tinker around with it while other players make their moves. This feature provides personal interest and engagement.

When leaving the platform with a single display connected to a single computer it becomes possible to make more of not only verbal conflicts, but also a political and economical conflicts to create social challenges. There are however also other ways to create such games. For example by utilizing physical objects such as cards and boards in conjunction with the computer game. Lundgren (2003) and Lundgren & Björk (2003) have recently been investigated such computer-augmented board games in order to find appropriate game mechanics

for future game designs. Computer-augmented platforms have, just like multiple-device platforms, the potential to support imperfect information games which consol games and computer games of today cannot support unless they are in online versions. Online games are, however, only occasionally played in a convivial fashion where people get together to play in local area networks. Convivial computer games can be significantly more interesting when multiple-device game platforms enter the market.

6.3. Other Systems Employing the Patterns

During the last five years several experimental systems have implicitly implemented, or have a potential to implement, the design patterns presented in this chapter. One of them is the i-LAND environment, where different kinds of computer-augmentation platforms like the DYNAWALL, the COMMCHAIR, and the INTERACTABLE have been tested (Streitz et al., 1999). Another project which implements the pattern is the BLUESPACE workspace (Lai et al., 2002), which provides users with a number of different screens and display surfaces, including an EVERYWHERE DISPLAY projector, which allow users to display graphics on any surface of their choice. The DESIGN CONFERENCE ROOM, COLLABORATIVE CLASSROOM and RECONfiGURABLE COLLABORATION NETWORK (Geisler et al., 1999) can also easily implement REGULATING PROMINENCE even though they do not utilize COMBINATIONS OF MOBILE AND STATIONARY DEVICES. The i-LOUNGE (Sundholm, Artman & Ramberg, 2004) also implements these patterns. Another way to implement it is to use occlusion on a digital table (see Scott et al., (2003) or for further discussion about digital tables). If the table knows where people are around it and where physical objects are on the table, it can display information so that one user can see it and not the other. One can also display information so that only people who know what to look for can see it (Intille, 2002).

There are, around us in our everyday life, different cooperative settings that implement REGULATING PROMINENCE to varying degrees. The counter in a shop is one such place where some parts of the desk belong to the shop assistant and some parts belong to the customer. The spatial properties of the desk provide natural surfaces for private, peripherally public and jointly public actions. We do, however, seldom

meet computerized systems that work according to the patterns presented here. The ones that work include physical objects of work and not digital information objects. However, professional practices can overcome this limitation by work-arounds. For example, in order to make activities peripherally public the workers speak aloud and overhear each other (Garbis, 2002; Artman & Wærn, 1999; Heath & Luff, 1992; Dourish & Bellotti, 1992).

It should also be noted that the user interface patterns are not very strong patterns since there is no clear way of saying when to use which. Furthermore, technical patterns like DISTRIBUTED EVENT MANAGER, and AD-HOC WIRELESS NETWORK should be developed.

6.4. In Summary

Co-located people do things individually while participating in collaboration. It is, however, difficult for designers to foresee what they will do individually and what they will do jointly. Participants therefore need to be able to move any information object between private and public states, but that is cumbersome to do with objects confined to a traditional PC-based workstation. Based on the empirical fieldwork in the three case settings, this chapter described a design pattern called REGULATING PROMINENCE, which addresses the problem. Designers can resolve it by making a platform where users can regulate how prominent they want to make information for themselves and others.

REGULATING PROMINENCE is an activity pattern describing activities of people in sociable situations. The second pattern in this chapter—COMBINATIONS OF MOBILE AND STATIONARY DEVICES—is an artefact pattern, describing how to choose technological platforms to create spaces of action where users can obtain REGULATING PROMINENCE. The third, fourth and fifth pattern—DROP CONNECTOR, GO CONNECTOR and SEND CONNECTOR—are user interface patterns describing how to allow users to seamlessly move information objects between devices in order to regulate prominence.

The patterns are based on field studies and design work where desirable use qualities were identified, categorized and translated into forces in design patterns. Conflicts between forces were noted as problems, and solutions were sought to establish design patterns. A multiple-device platform called LOCOMOTION was finally derived

from the patterns to provide an example of how they can be realized, but other platforms also have the expressive potential to realize the pattern of REGULATING PROMINENCE so that users can control the shades and grades of information visibility.

7. Reflection

This thesis addresses what the appropriate units of analysis are in interaction design as design of use, where use is thought of in terms of mediation. The models for thought specifically addressed are multiple aspects of use, characters, design patterns and use qualities.

The empirically grounded work in Chapters 5 and 6 have demonstrated how these concepts can be used within the context of design of interactive systems for sociable use. The conceptual aspects of the research problem, rather than the empirical aspects, are dealt with in this chapter where the case studies are further reflected upon in the light of the theoretical framework. In contrast to the empirical chapters, this chapter aims at moving the results beyond the specifically sociable use situations of the three cases, to sociable use of interactive systems in a more general sense. This chapter reflects on the cases while the next chapter discusses consequences of the results for the practice, research and learning of interaction design.

7.1. Characters of Systems in Use

As argued in the introductory chapter, interaction designers and researchers need a wide variety of concepts that they can use to describe and analyse the use of the products that they are designing or study-

ing. Too few or too coarse concepts to see their object of design through may make them insensitive to the shades and nuances of the design situation.

Thinking about what *character* to give to the usage of a system-to-be-designed provides the designer with a conceptualisation of how it shall behave and present itself at the level of use. The character can be seen as a relatively coherent set of use qualities of the system and examples of such characters include the tool, the material, the system component, the dialogue partner, the medium and the arena.

In Chapter 2, the previous conceptualisations of the character of interactive systems were described. Kammersgaard (1988) described them as consequences of the perspective, which is applied in the design, in the analysis or in the usage. Löwgren and Stolterman (1998) focused on using them as consequences of the design where the interaction designer designates a character to the system. The list of characters was not regarded to be exclusive, but rather providing a starting point for discussions about characters. Svanæs (2000) wrote for instance about the computer as a material, but that is here treated as an aspect of tool usage. Janlert and Stolterman (1997) argued that a consistent character, regarding behaviour and appearance, provides support for anticipation, interpretation and interaction, and when a character temporarily behaves or appears differently it can be said to change mood. The character of a system in use was defined as a coherent and relatively stable set of qualities of the actions that a system mediates. Given the theory of mediated action, an action was defined as the induction of change in an object by a purposeful subject using a mediational means.

From previous literature it was not clear what made up the character of a system in use and therefore the concept was applied to the three cases of sociable situations use for further investigation. In a variant of the medium (the common resource) and a variant of the tool (the resource) was observed. This means that there are differences between using a system while being co-located with others and using it in solitude. The observations also showed that a system in sociable use could change between different moods: turn-taking control, parallel control, and mediated control.

The Flow of Dynamic Characters

The systems studied in the three cases did not support very fluent and swift changes between different characters and different moods; it was cumbersome for users to use a system in different ways (as also described in Arvola (2003b)). A number of workarounds and insufficient strategies were used: printouts, turning screens with the risk of exposing things, using a system as tool and ignoring other people and so on. In Chapter 6 the design pattern REGULATING PROMINENCE was presented as a remedy to that.

Bødker (1996, p. 154) would recognize this from her studies. She writes:

> We see an artifact as supporting several interwoven activities that deal with the same or connected objects. In the course of a specific activity, various focus shifts and breakdowns occur, by which the object changes. In some cases, this change may be viewed as a change of activity; in others, the overall activity remains the same, but the purposeful actions change. Being involved with different objects and subjects through or in the artifact is parly determined by the purpose of the activity, and partly by the "intrusion" in breakdown situations.

The goals and motives in an activity shift constantly and the environment of the interaction also changes. For instance, people enter and leave activities, which means that interactive systems change between being in joint use and individual use. This transforms the activity in a fundamental way and the character of the interactive system in use changes accordingly. If the system does not support a desirable kind of character or mood, it is likely to hamper the naturalness of people's social interaction as well as the instrumental usage.

Janlert & Stolterman (1997) argue that a consistent character is important for users' interpretation, anticipation, and interaction with an application. That consistency should apply to every action across all characters that the system may have in its usage. If the entire system is to be snappy, every action that is performed must be snappy. One could, however, claim that an interactive system should belong mainly to one character, but the results of the studies in this thesis indicate that it is more rewarding to view each component of it as being able to take on different characters. This is in accordance with Kam-

mersgaard's (1988) when he views them as perspectives that can be applied to the system as it is designed, analysed and used. It is, however, the responsibility of the designers to decide which ones should be supported and afforded in different situations of use.

If one regard each system as being able to take on different characters it would mean that the users would be able to use one and the same system quite differently from one moment to the next. An ecologically flexible system would allow users fluently switch between characters.

LOCOMOTION was designed to be such a system. For example, using the LOCOMOTION platform, a clerk at a bank would be able to use his private screen as a *tool* with the information *material* as the object in focus when input was necessary and when sensitive or secret information was being browsed or entered. Extemporaneously needed information could be moved from the private screen to a shared tablet that the clerk and the customer would have on the table between them. They would then use the system as *common resource* and the clerk would have the private screen as a *resource* in the background while attending the customer.

The example above depicts how complex motives give complex objects. The clerk has several motives in the meeting with the customer. He or she wants the customer to be happy and content, and the clerk may also want to change something in the financial behaviour of the customer. The customer is a communicational object (another person) who action is directed at. The clerk also need make sure that all necessary information is put into the computer systems so that a decision is well grounded and documented. The information in the database is an instrumental object (a material) which action is directed at. Furthermore, the clerk want to feel safe in their ability in using the computer systems and be sure that nothing will go wrong. The experience of feeling safe is an aesthetic object which action is directed at. When something goes wrong the clerk want to figure out what happened and what to do to get it right. The interactive system is then a constructional object which actions are directed at. Finally, the clerk does not want to risk exposing secret information the customer, information about other customers for instance. The idea of secrecy is an ethical object which actions are directed at.

Using any computer system involves a flow of different characters of the relation between subject, artefact and object. Fällman (2004, p. 360) argues that "a desktop computer typically holds a fairly stable relation to its user" while the character of the relation between user, mobile information technology, and world is "multi-stable." He observes that when taking a photo with a digital camera the character change dramatically a number of times during a period of a few seconds. The empirical work at the bank, in the living room and in the studio, has however showed that a desktop computer does not have a stable character. When Fällman think of the desktop computer as stable in character he does the same thing as HCI-researchers have done for a long time; he sees before him a picture of one lone white-collar worker doing mechanical office work. This picture is only an oversimplified and prejudiced stereotype. There is no reason why desktop computing should not be viewed as equally social and aesthetic as mobile computing. Fällman is however partly right in that this flow of characters, or what he calls multi-stability, is a large part of what mobile technology is. We saw that there was a resistance in the desktop computer to undergo these shifts in character, and instead the ecologically flexible LOCOMOTION was design based on multiple mobile as well as stationary devices.

Every time an action is directed at a different kind of object (communicational, instrumental, aesthetical, constructional or ethical) the character of the mediating system will change. Table 7.1 describes the kinds of objects that correspond to a certain character and the use quality aspects that are highlighted. A system is used as a tool when the object, which the subject wants to induce a change in, is seen as a material. The material is often computer based as well and can hence also be regarded to be a character of an interactive system. Examples of materials are for instance the information in a database, the pixel-based image in an imaging program, or the stack of cards in HyperCard when they are being constructed (Svanæs, 2000). The system is used as a medium when the object that the user wants to affect is another person. When the media is consumed the aesthetics of it is in focus rather than other people, for instance the director of a movie. It is then used as an art piece and actions are directed back at the experience of using the system. The system itself is objectified when it is used a dialogue partner. The user utilizes some form of language as medi-

ating means to communicate with the dialogue partner, which in turn performs the actions that the subject wants it to. When the system is viewed as a system component, it is, together with the user, utilized as a means to perform a function. The arena is a character that clearly is a composite of several other characters. It is a media since a subject directs actions at other people by means of his or her avatar. It is also a tool since the subject can use the avatar directed at the virtual environment. Within the arena there can also be autonomous software agents that work as dialogue partners.

System as	Object	Highlighted Aspects	Comment
Tool	A material	Instrumental	
Medium	Other people	Communicational	
Media-in-consumption	The subject's own experiences	Aesthetical	
Dialogue Partner	The system itself in the form of an agent.	Instrumental Communicational	A language is used as mediating system to interact with the dialogue partner
System Component	Other system components	Instrumental Constructional Communicational	The user-artefact ensemble is used by the organisation
Arena	Other people, agents, or a material	Communicational Instrumental	Composite of tool, medium, and dialogue partner
Machine	The system itself	Constructional	The complexity of the system is in focus
Resource	A material	Instrumental	A resource is secondary and not the centre of attention
Common Resource	Other people	Communicational	A material used for shared reference

Table 7.1: Characters of interactive systems and their corresponding objects, which actions are directed at.

In the analysis of the characters of systems in use in the three cases three different moods were observed. Participative control was seen in a mediated form where one user was backseat driving; telling the other what to do. This is similar to the character of dialogue partner, but the

object of the backseat driver's actions is a real person (a communicational object) rather than a software agent. Another participative control mood was the parallel control where several users controlled the same interactive system by means of multiple input devices. Given that the users can have conflicting motives and interests there may then be conflicts, especially if they are forced to direct their individual actions at the same objects. The third participative control mood that was observed was turn-taking and in the leisure case users quite often switched between turn-taking and backseat driving. When a primary user got tired of being told what to do he or she could hand over the control.

Constituents of a Dynamic Character

Figure 7.1 illustrates the constituents forming a dynamic character of interactive systems where the complex motives in a sociable situation are responsible for complex objects that are highlighted to different degrees depending on how the activity proceeds. At one moment other people may be in focus at which an interactive system may be used as a resource. At another moment the information content may be in focus while the other people are periphery, at which it is used as a medium.

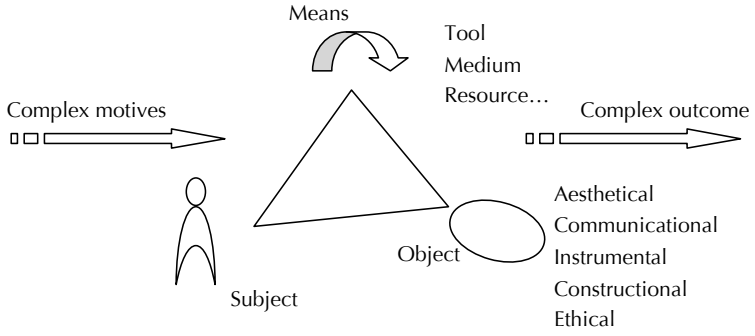

Figure 7.1: Constituents forming a constantly shifting character.

The consequence of designing for a specific character is that one highlights certain objects that the user acts towards. An interactive system that is designed as a tool implies an instrumental object, a medium implies a communicational object, a piece of art implies an aesthetic object and so forth. If a teller system at the bank is designed as a tool it will centre the information that is to be manipulated. Would it

instead be designed as a common resource it would place the text as a meaningful representation to be jointly manipulated with other people in centre instead. If it were designed as a medium it would include communication between the bank, the clerks and the customers. An interactive system that is designed as a tool without thought of other people will limit its use as a common resource or a medium. The tool highlights the primary user's instrumental object and makes it harder for that user to utilize the system for actions directed at other kinds of objects. While the designed character of a system highlights one object for the user it makes the other objects peripheral. The character provides the cues on how to use the system and what to expect from it.

In Heideggerian terms, a character of a system is a perspective given to the user. It is given by means of how the content and the form, including the medial form and the interactive form, are designed. It is a perspective on the space-of-action that the user acts within. It provides the objects and means that are available for action and it is not only designed beforehand but also constructed in-situ, formed by the activities that take place within it. For example, when people are in a sociable situation some things are present to one person but not to others within the same space-of-action. A person can bring present objects into his or her own presence, making them ready-at-hand, but he or she can also bring them into the presence of others. This is what happens when someone extemporaneously brings attention to something in a conversation and accordingly reconstructs the character of the systems used in that situation.

Different people in the same space have different disclosures of the world depending on what perspectives it gives them. The perspectival givenness of a usage situation is designed by designers and continuously modified by users. It must be a goal of interaction design to design the perspectives on the space for actions that one wants to provide users with without hindering them from taking their own perspectives.

7.2. Working with Use Qualities

Let us now turn from the theoretical construct of characters to the methodological implications of working with use qualities in interaction design.

Eliciting and Elaborating Desirable Use Qualities

The case studies in this thesis shows that use qualities can be elicited in a situation of use by approaching an empirical material that describes the usage of systems with the question of what that should characterize a certain system when it is in use: the desirable use qualities of a system. That empirical material could be, for instance, field notes from interviews and observations, videotapes, scenarios *et cetera*. When doing a field study of a situation of use one can use Figure 7.2 as a mnemonic aid.

The figure illustrates the constituents of usage of technology seen as mediated action. Use qualities are emergent properties of the entire mediated action system where a subject performs actions driven by motives to achieve some outcomes. Actions are mediated by means, directed at an object, and situated within contexts (communicational, cultural, historical, technological and physical).

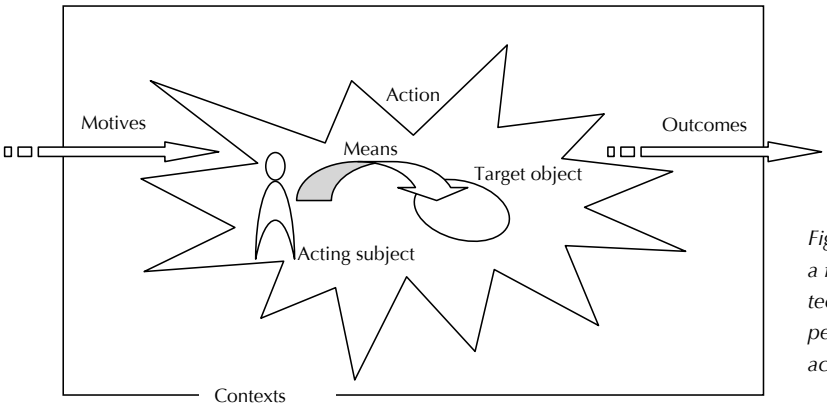

Figure 7.2: An illustration of a framework for a usage of technology, seen from the perspective of mediated action.

Information about the usage of an interactive system can provide the basis for eliciting the desirable use qualities that are emergent in the usage. The empirical material, in the form of field notes, scenarios and transcripts from interviews and observations, can now be analysed by reading it to determine what the usage should be characterized by. All phrases and statements that carry any values and valuations should be highlighted. Especially, one can look for adjectives, adverbs and descriptive or prescriptive noun phrases. Descriptive phrases are

transformed to prescriptive ones (e.g. 'difficult to go between systems' is turned into 'seamless tool integration').

At this stage it is time to start categorizing the identified phrases and statements into desirable use qualities that are given a label. As in all qualitative research, one needs to try to figure out if there are common nominators behind different statements. For instance, two statements were regarded to be about the use quality 'ego challenge' when one player of the quiz game said, "It's fun, a challenge, and it's good for your ego if it goes well," and another said, "above all, it's fun to win, see if you know anything and learn."

Motives in a mediated activity are always complex as shown in the section above where a dynamic character was identified. Every categorized use quality must therefore be refracted to disclose the different quality aspects that are present in every use quality. The use quality prism depicted in Figure 7.3 can be utilized to accomplish this.

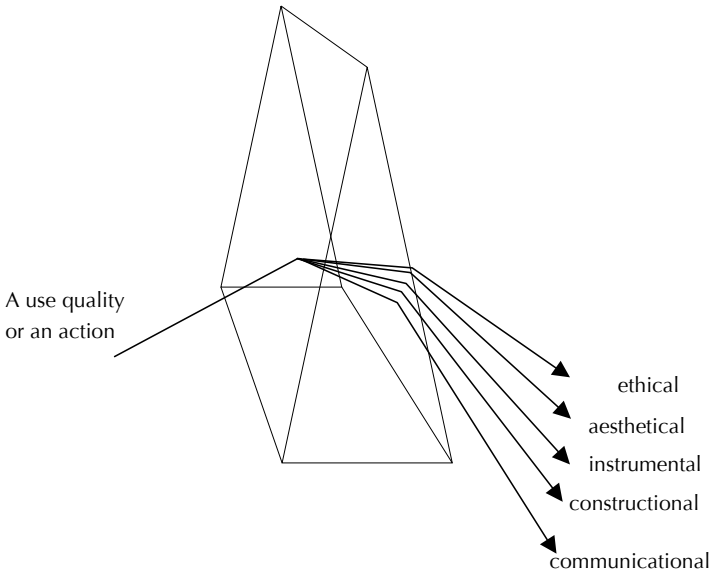

Figure 7.3: The use quality prism where a use quality or an action is refracted to disclose its instrumental, communicational, aesthetical, constructional and ethical aspects.

A complementary way is to firstly identify all actions that are performed in an activity and then highlight their different quality aspects by applying the prism on the actions instead. For instance, in the usage of a teller system at the bank there is an action that can be called 'transfer money' and the system has a corresponding functionality. The instrumental aspects of that action include that it should be swift

since there are customers waiting. Also part of the instrumental aspects is that it must be made between the right accounts. The communicational aspects includes that the transfer often is performed with the customer waiting for the transaction and the clerk must seem competent in his or her work. An aesthetical aspect of the action is that clerk should feel confident in that the action is correctly performed. An ethical aspect is that he or she performs the action without violating bank secrecy. Finally, a constructional aspect is that all the systems need to be online in order for the action to be performed.

This will provide a list of actions that are part of the activity and their instrumental, aesthetical, communicational, ethical and constructional aspects. The descriptions of what the different aspects are of each action can then be used to write desirable use qualities for each action that is performed by means of the interactive system. In the example of transferring money by means of the teller system, such a list would include correctness, confidence, speed, secrecy, availability and politeness. The analysis of other actions would provide more qualities that would need to be categorized across actions to develop the entire holistic character of the system-to-be-designed. When the list of use qualities is derived each one of them can, in turn, be refracted in the use quality prism. For example one can look at the instrumental, communicational, aesthetical, ethical and constructional aspects of the quality correctness, which is a quality with emphasis on instrumental aspects but still carries the other aspects: the feeling of confidence in that one performs the actions correctly and the role of other people besides the clerk in accomplishing correctness.

Every person will see the prism from a slightly different perspectives depending on their background and disposition to the world and the qualities of a system in use are hence refracted differently for each individual. Some people have an inclination to basically think about instrumental aspects while others tend to focus on aesthetics, for instance. It is for this reason a good idea to work jointly when doing use quality analysis in order to see more of the complexity in the design situation.

In the chapter on the use qualities of the systems in sociable use (Chapter 5) it was demonstrated that use quality design objectives could be ordered hierarchically to highlight the dependency between different objectives.

This will provide a means-ends hierarchy where motives of the activity of using the interactive system are at the end and product features are at the means. Some use qualities are ends in themselves while others only serve to fulfil a higher order quality. As seen in Chapter 5, yet other qualities can be both ends in themselves while also being necessary for other qualities.

A hierarchical analysis of use quality design objectives should not be seen as a hierarchical breakdown of higher order qualities to lower order, it should rather be seen as a search for means to achieve good quality in use. A quality will not automatically be fulfilled if the lower level qualities are fulfilled.

An objectives tree helps to clarify what the designers need to fulfil in their product. As Cross (2000) writes, the client who comes with a brief to a designer may know the type of product that is wanted but do not know the details, or the variants that are possible. The client may initially be even more vague. Clarifying the use quality design objectives is necessary for the interaction designer to know what to design for, and how to assess solutions, and it can also function as communicative aid with the client. The early statements of objectives will be changed, expanded, contracted or completely replaced as the problematic situation is better understood and as design solutions are developed. In cross-functional design teams this is even more important since every designer brings his or her perspective to the design situation and this means that each and every member of the team may have conflicting or competing design objectives. Being clear on what to aim at is therefore vital to success of the design process.

Jones (1992, p. 199) writes about stating objectives:

> The stating of objectives is undoubtedly one of the most important and difficult parts of designing. […] It is impossible to prove that objectives are correct before a system has had its intended, and unintended, effects upon the situation as-a-whole. This is because the future value of an action depends upon human opinions that cannot be foretold because they are only partly governed by the responses of persons concerned. There is a large personal part of this response that is highly unpredictable and a social part that is more stable. All one can do, in stating objectives, is to identify what appear to be the more stable aspects of the responses…

The apparent instability of personal responses is partly due to that the designer has not looked behind the responses to see the mechanisms that produce them for that person within his or her life-world. Instead the designer takes the expressed will or expressed need as is. In order to understand a response it is needed to understand what it was that made a person express a will or a need in a certain way. This is where interpretative research enters as an approach in design.

Use qualities are what characterizes the use of an interactive system, but used as design objectives they are seen as the things that stakeholders in a design projects care about. Qualitative field studies is a suitable research tool for identifying what people care about, through the analysis of their motives for doing what they do, in the way they do, to the things and people they do it to.

Creating Design Solutions based on Desirable Use Qualities

When trying to identify the design elements that should be part of a design composition, one can, as described earlier, start by examining the motives in the activity where the system-to-be-designed is used. The description of constraints on the design and why people do what they do, provides the desirable use qualities—the use quality design objectives—and these objectives are then clarified in an objectives tree. Based on that work, one can start sketching out possible design alternatives. The process is illustrated in Figure 7.4.

In this model of interaction design, an interactive system or a component of the interactive system is conceptualized in terms of form, information content and the purposes of the system or the component. The form can in turn be deconstructed into its medial form (text-based, video, 3D, 2D) and its interactive form. Examples of interactive forms that we all recognize include the batch file, forms to fill in, command-line, hypertext and WIMP (Windows, Icons, Menus and Pointer). The purposes of a component or an entire system are to contribute to the desirable use qualities of the system. Given that one has the desirable use qualities of a system, the motives of the stakeholders of the system, and the contextual constraints (e.g. laws and legislation or the temperature in the physical context of use) one can start figuring out the purposes of the entire system as well as individual components.

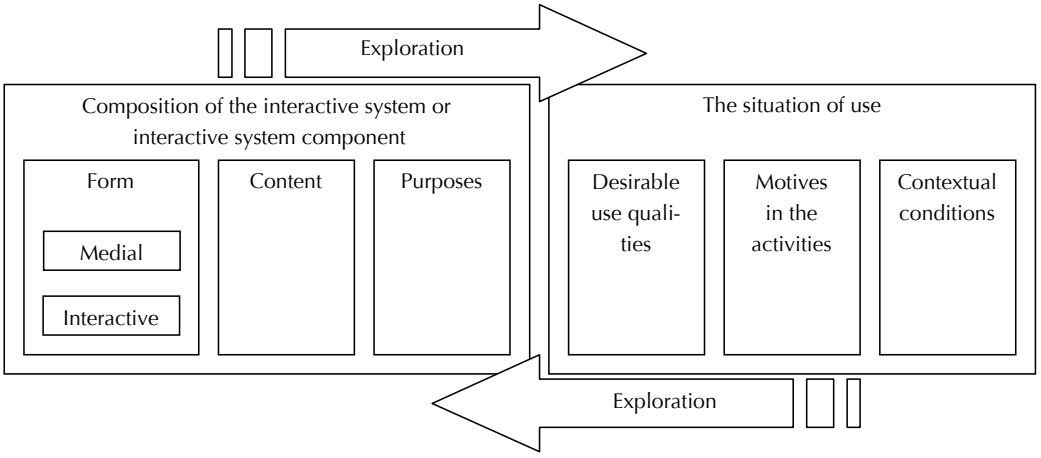

Figure 7.4: The exploration (in design or analysis) of an interactive system or a component of it, and the exploration of a usage situation meet in the purposes of the system or the component and the use qualities it contributes to.

Take for example the connection between devices in LOCOMOTION. The form of a drop connector was chosen rather than a go connector or a send connector since it was easy to program and easy to adapt to other platforms. It did not intrude on privacy and by utilizing drag-and-drop it provided seamlessness for users when moving information objects between devices. The purpose of the connector was hence to provide the function of moving objects between devices, which matched the motives in the situation of use, and contributed to the desirable use qualities of extemporaneity, participation, autonomy, politeness, seamlessness, ease of programming, and portability. The interactive form that made up the connector was drag-and-drop of graphical objects to a floater. The interactive form of a floater meant that it behaved so that it could be dragged, docked to the border of the screen, and had customizable auto-hide and always-on-top. When an object was dropped on it, it provided feedback in the behaviour of a visual surge representing that the object was being transported. It also had the medial form of drop-shadow graphics and more specifically a metal plate (typical to Mac OS X) with drop areas that appeared to be countersinked. The information content of it included the drop areas representing other devices that were grouped

together to represent them as part of the same peer-to-peer network. The information content of the objects dropped onto it was references to information objects (such as files and streams) in the form of strings.

Cooper and Reinmann (2003) have sketched up a model of interactive form, similar to the one given above. It includes the concepts of form and behaviour, and they use the term meaning instead of content. They do, however, not make much use of their model in any of their analyses of interactive systems.

Laurel (1993) also uses the term interactive form and sets up a model based on Aristotelian conceptions of why things are the way they are. She lands in a model that has some structural similarities to the model presented here (see Figure 7.5, adapted from Laurel (1993, p. 51)). In her view the material of interactive systems goes from the things people can perceive at the level of engagement that make up the experiential patterns of the interaction, up to the language of signs that is utilized, further up to the thought of the interaction, that is the intended function, and finally up to the character and action of the interaction. The formal causes, that is the representation of action is driven from the action that is performed an all the way to the things that can be perceived: the engagement in look and feel.

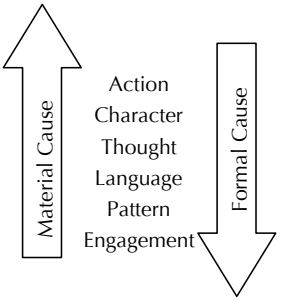

Figure 7.5: Laurel's model of causal relations among qualitative elements of structure in human-computer interaction.

The model that I presented is similar to Laurel's model in that the form corresponds to Laurels engagement and pattern. The content corresponds to Laurels language, the thought to the purpose, the set of use qualities corresponds to the character, and the motives and context corresponds to the action.

The model that I have developed does, however, not view the form as being in a causal relation to the content. These two do instead go hand in hand in a composed whole. My model also connects the composition of the interactive system with the analysis of the usage situation, by means of the conceptual construct of desirable use qualities that can be matched to the purpose of a certain component in the design. Laurel's model does not cover these issues even though it has structural similarities.

Use Qualities and Design Patterns

The chapter about design patterns for sociable use (Chapter 6) illustrated that the desirable use qualities in a design situation can be viewed as forces. At some times these forces are in potential conflict

and solutions to them can then be identified by comparing the conflict situations with the non-conflict situations in order to identify features that exist in the latter but not in the former. A design pattern can then be established if similar features are present in several of the situations where the forces are not in conflict.

Knowledge about what kind of design solutions work in different situations can then be transferred to other design projects. The applicability of a design pattern can be judged by examining if the forces described in the pattern can be found as use qualities in the design situation at hand.

7.3. Ways of Being Responsible

The mechanics behind the dynamic character and the aspects of the use quality prism can be described in terms of the different ways to be responsible for the appearance of technology as Heidegger (1974) formulated it in the essay The Question Concerning Technology (Die Frage nach der Technik). In Heidegger's model of causality, which is based on Aristotelian concepts, there are four ways to be responsible for the appearing or bringing to light (apophainesthai) of a technology: hyle, eidos, telos and logos. Heidegger gives an example of a silver chalice:

The silver is as the material (hyle) of the chalice responsible for making it. By quality of being a chalice, rather than a ring or a buckle, it is also indebted to its own chalice-like form (eidos). The silver that appears in a chalice-form, as well as the chalice-form in which the silver appears, are both in its own way responsible for the appearance the chalice.

The third way of being responsible for the silver chalice is by its end in the sense of purpose, fulfilment or accomplishment (telos). It is the context in which the chalice will be used, for example in communion, which limits and ends its definition as a chalice.

The fourth that is responsible for the chalice is the silversmith's capability of bringing the chalice into appearance (logos). The sense of logos that Heidegger draws upon is that of deliberation and consideration [Ger. überlegen]. The three previously mentioned ways of being responsible for the silver chalice are indebted to the silversmith's deliberation and consideration for appearing in the way that they do.

In Heidegger's model of causality, these four ways of being responsible for the appearance of a technology are separable, but they belong together.

This is related to the notion of accountability (e.g. Garfinkel, 1967; Eriksén, 2002), which is how someone shows others what he or she does and take responsibility for it. It can also be how responsibility is demonstrated to be someone else's. It can be accounted for by any of the four constituents of Heidegger's model.

We can see how the material in Heidegger's model corresponds to the constructional aspects of the use quality prism and hence the constructional object in the interaction character. The form corresponds to the aesthetical aspects and the purpose to the instrumental. The deliberation and consideration is that of the designer who makes the interactive system.

Aristotle's framework of causes have also been utilized by Laurel (1993) do describe the driving forces of human-computer activity and for describing the structure of its qualities, as shown in Figure 7.5.

It is, however, not straightforward to see the design of interactive systems as the design of a silver chalice. Let us return to the quotation by John Chris Jones (1992, p. xxxiv), which was introduce in the first chapter:

> A potter modelling a piece of clay into the 'perfect' shape for a cup is an ancient, and I think unhelpful, metaphor for the process of designing. When design was limited to the shaping of objects it perhaps sufficed, but now, when the scale has grown to that of systems of objects, and the activities of people, the metaphor has become destructive. We are not clay, not infinitely malleable, not dead. What is the right metaphor now?

If interaction design is not the same as making a cup in clay or a chalice in silver, what is it then? Looking back at Heidegger's model of causality and relating it to the changing interaction characters, we can see that it is not only the silversmith who by deliberation and consideration composes the other aspects. That would be close to technological determinism, and indeed in contradiction with the results of this thesis. Instead the results suggest that the users of technology also composes the usage an interactive system by changing the interaction character in-situ. The interactive system can hence be seen as a struc-

turing resource (Lave, 1991) rather than a dead physical object. The structuring resource in the form of the interactive system gives a perspective on the world that also is affected by what the user brings to the situation in the form of habituated and appropriated practice. By co-constructing the perspective on the world, together with the user, the interaction designer not only designs the interactive system, but also to some degree designs the subject and the object in the activity of using the system.

Designing an interactive system is different from designing a silver chalice in other aspects as well. As Redström (2001) points out, and Jones (1992) before him, time and not space alone is a design parameter in the design of non-physical objects. Interaction design thus has a temporal aspect to it that Heidegger did not have in mind when talking about the ways to be responsible for the appearing of the object. And as argued by Holmlid (2002) the material of interaction design, in contrast to for instance pottery, is not passive but interactive and even pro-active as well as dynamic rather than static. In fact, interactive systems have the capacity to evoke new perspectives and can be used to think with, as Turkle (1984) showed in her studies of the effect of computers on how people think. In her view the computer is "a constructive as well as a projective medium (p. 5-6)." She writes:

> The computer's chameleonlike quality, the fact that you program it, it becomes your creature, makes it an ideal medium for the construction of a wide variety of private worlds and, through them, for self-exploration.

Heidegger's model of causality does not cover the dynamic nature, interactivity and pro-activity of the computer as a design material. The user's projection of him- or herself through the material as well as how the object restructures and is structured by the social world is not covered in that model. The communicative and ethical aspects in the use quality prism and the communicative and ethical objects in the interaction character are not dealt with. Winograd and Flores (1986), building on Heidegger, used speech act theory to cover communicative acts, but Suchman (1991) criticized their reasoning for missing the important political and ethical aspects. It is also obvious that speech acts would not include the projection of ones self-image through the use of interactive systems. Svanæs also notes that Winograd and Flores

instead could have made use of Heidegger's concept of being-with [Ger. mitsein], which indicates that there is no socially isolated action. As mentioned in the discussion on participation in Chapter 5, actions are never performed in isolation and practices are taken over from within a community. This is also true for actions being performed through the means of computers. Theories of practice extend the idea of being-with to contemporary social science; distributed cognition, situated action and activity theory are therefore of great use in interaction design.

Just like Turkle, Svanæs (2000) have noticed how an interactive system can change character in the middle of usage. He describes the chameleonlike quality or the multimedia software HyperCard (p. 82):

> When I build a HyperCard stack, it clearly has tool (and material) properties. When I navigate in a stack built by someone else, it is no longer meaningful to see it as a tool. I am then interacting with a medium, and that medium has "interactive play" properties.

It is, however, even more complex than Svanæs and Turkle give expression for. When I am constructing a game for my colleague Jonas in Director, the game is a material: a constructional object. Director is a tool for that. *At the same time* it is a medium, which I project myself through thinking that Jonas will smile at a certain point in the game. When Jonas then is consuming the game, playing it, he is doing it with expectations based on that it is a game and that I have constructed it. Assumptions about the author play a role in the experience and the interpretation. Interactive art pieces, computer games, and similar interactive systems are media in consumption use.

The plastic nature of the characters suggests that the computer-as-tool and the computer-as-medium are not exclusive of each other, which is opposite to the view in activity theory. Svanæs uses the philosophy of Merleau-Ponty (1962) to overcome this perceived dichotomy (Svanæs, 2000, p. 101):

> When perception is understood as an active process involving the totality of our body, it no longer makes sense to see it as a passive reception of information through a medium. When action is seen

> as an expression of our being-in-the-world, it no longer has meaning to see hammering etc. as a purely "bodily" activity.

The two aspects (the communicational and the instrumental) of using interactive systems and their corresponding characters (the medium and the tool) are constantly present in the usage of interactive systems, even though they are analytically separable. As interaction designer, it is reasonable to view them as perspectives to provide to the users, but they should not be seen as exclusive of each other. Instead one should think about how to design both of these aspects for the user. In addition, thinking in terms of other variants as well as compositions based on these basic characters is useful. The tool has its material aspects and in interaction design, not only the tool is designed but also the material it is applied to. The tool also has its objectified form that is disclosed in a breakdown: the constructional object. While the material is designed so is also the medium. At the very moment the material is consumed or used by somebody else but the originator the interactive system is turned into a medium. One can continue to elaborate different combinations of characters and use quality aspects for a long time, but the lesson here is that one as interaction designer, need to deliberate and considerate their combinations and flow to reach the desirable use qualities that one has set up as objectives for the design project.

7.4. In Summary

The conceptual aspects of the characters, patterns and qualities of interactive systems in use have in this chapter been reflected upon in the light of use as mediation and multiple aspects of use. The ambition was to move the results beyond the specifically sociable use situations of the three cases, to sociable usage of interactive systems in a more general sense, and perhaps even design for any situation of use.

Thinking about what character to give to the usage of a system-to-be-designed helps designers to deliberate how the system should behave and appear as a consistent whole. Examples of such characters include the tool, the material, the system component, the dialogue partner, the medium and the arena. The case studies gave examples of how complex motives in a situation of use are responsible for complex objects in the activity. Each object is highlighted to different degrees

depending on how the activity proceeds. At one moment other people may be in focus at which an interactive system may be used as a resource. At another moment the information content may be in focus while the other people are periphery, at which it is used as a medium. The designed character of a system in use gives a perspective to the user, but users continuously modify this perspective in their activity of use. A goal of interaction design is to design the perspectives on the space for actions that one wants to provide users with (highlighting the things one wants to bring fourth and placing other things in the background), without hindering them from taking their own perspectives.

Turning from characters to desirable use qualities, the case studies in this thesis have suggested that approaching an information material in the form of descriptions or scenarios with the question in mind of what should characterize the usage can highlight desirable use qualities. Descriptive and value-laden utterances and phrases are marked in the descriptions or the scenarios and categorized to form desirable use qualities. The different aspects (instrumental, communicational, aesthetical, ethical and constructional) of the qualities are finally highlighted by applying the use quality prism to them. A complementary procedure is to identify all actions performed and highlighting their different quality aspects by applying the prism on them. Furthermore, moving from motives in an activity across use qualities of the interactive system can identify the purposes of a component in a design solution. The aim is to make sure that the stated purposes of the component contribute to the desirable use qualities of the entire interactive system. The form, including its medial form and interactive form, as well as its content is then designed to meet the stated purposes of the component.

Moreover, the case studies have illustrated how desirable use qualities can be represented in the form of design objectives that can be hierarchically ordered to visualize their dependencies, and make a clear statement of what a design project should aim at. In addition, the case studies demonstrates that traditional qualitative analysis into categories of use qualities of an artefact, can provide an empirical basis for forces in a CSCW or HCI design pattern. Such patterns can in turn work as vehicles for knowledge between specific design projects.

The lesson to be learned from the reflections in this chapter is that, one should as an interaction designer, deliberate and considerate the

combinations and flow of characters and qualities that one want to give to an interactive system in use. These dynamic characters and qualities will provide the users with a perspective on their space for actions, which they will modify and reconstruct in-situ through their activities. They will in the end all see different shades of the situation of use depending on what aspects of the use quality prism they care about at that time.

8. Discussion

The aim of this thesis has been to provide, specify and make use of units of analysis and models for thought, reflection and articulation in interaction design for sociable use. The objective is to highlight variations in shades in the complex of usage as unit of analysis in interaction design. The main contribution of the thesis is hence the empirically grounded models for thought and units of analysis based on a socio-cultural theoretical tradition where use of interactive systems is thought of as mediation and the design of it is thought of in terms of patterns, characters, and use qualities. This final chapter discusses consequences of the results for the practice, theory and learning of interaction design.

8.1. Design of Use as Design of Mediation

This thesis has explicitly taken a mediated perspective on interaction design where the design object is *use* of interactive systems. It is built on a socio-cultural history of ideas, but is also strongly influenced by phenomenology.

One of the premises of this thesis is that we (as humans) are engaged in the world before we are reflective and we find ourselves thrown into a situation where we act and have to act (Heidegger,

1981). In this being-in-the-world we are directed towards things we care about. This predisposition for action and this directedness are among the most important things that interaction designers try to manipulate. By means of the designed product, the designer provides the users with a perspective onto their space for actions (the space which is given for action). The design of the interactive system places some objects and aspects in focus, while it places other objects and aspects in the background; in other words, the interaction design presents the space for actions to the users. In this I adhere to Winograd's view on interaction design as it is expressed in the interview made by Preece, Rogers & Sharp (2002) where he thinks of interaction design as the design of a space for people, where that space has a temporal flow and is in dialogue with the person.

For example, when a computer game starts up it immediately sets the mood for the player. It must communicate that it is a game so that the aesthetical aspects are forefronted for the player. If it looks like a word processor or like a tool, the instrumental aspects will come into focus and the user will be disappointed when he or she realizes that it cannot be used for anything useful. A perspective on the space for actions has immediately been set up.

The Human-Computer Ensemble

As with the relation between any agent and the mediating artefact, the user of an interactive system stands in an irreducible tension to it (Wertsch, 1998). This is a proper unit of analysis for interaction design. It is not the user alone who makes something happen, nor is it the interactive system alone. It is rather the user together in a communion with the interactive system, which is intellectually and culturally developed, mastered and appropriated, that makes something happen. Designers need to figure out how to make this joint system work as a functional whole in the world (Hollnagel & Cacciabue, 1999). The design of the interaction between the human and the computer-based interactive system is the first basic unit of analysis for interaction design, and it is what most people think of when they think of interaction design.

To give an example, one form of interaction between the clerk at the bank and their new computer systems was through a command language. The old clerks from one part of the organisation used this

because they were used to the old system where the commands came from. They were very difficult to learn for users from other parts of the organisation, and they instead used less efficient tabbing or point-and-click. Here we see different forms of interaction within the joint human-computer system, all of them with their pros and cons.

Breaking Down the Ensemble

When the joint system functions in the world without friction it is the object for the activity of use that is in focus for the user. The interactive system disappears into the background and the user acts in communion with it. At this level, the human-computer ensemble interacts with the world. This interaction is a second basic unit of analysis for interaction design.

The user's focus can, however, be transferred from the object for the activity of use to the interactive system, making it present-at-hand and an object of scrutiny. This is the process referred to as breakdown, conceptualization or objectification (e.g. Bødker, 1996).

This thesis has shown how the objectification of interactive systems in reflective moments can help in disclosing their qualities in use. They become particularly apparent in the contrast between alternatives. By talking in terms of how it is and how it should be in use, informants, workshop participants, and testers of new technology helped in forming the desirable use qualities into design objectives to be used in the design process.

Designing Resources and Constraints for Interaction

As already mentioned, the designer gives a perspective to the user by placing some objects ontologically near the user and ready-to-hand for interaction, while placing other objects (or aspects of them) in the background. The perspective, which is given, can be thought of as giving resources for interaction and placing constraints on interaction. This is the terms Lave (1988, 1991) would use. It was for example shown in the studies from the bank that a system that was presented to users as a tool constrained them to have a tool-like interaction at which they had to excuse themselves for ignoring the customer. There was no easy way to invite the customer into the interaction and use it as a common resource. Here we saw how the interactive system

structured the interaction between users. This interaction is a third unit of analysis for interaction design.

Components of Use Activities and Interaction Design Artefacts

The qualities of an interactive system in use emerge from the activity of using it. Burke's pentad of human actions and motives (Burke, 1969; Wertsch, 1998) is quite useful in interaction design, and it was translated into Figure 7.2 in Chapter 7. In terms of mediated action the activity system would be described as composed of acting subjects, actions, means, target object, motives, outcomes and contexts. These components can be used when analysing usage for design purposes by answering the questions in Table 8.1.

Table 8.1: Components of a mediated activity system and their corresponding inquiring questions and the design representations produced when answering them.

Component	Question	Design artefacts
Acting subject	Who is?	Personas and user profiles
Action and target object	Doing what to what?	Services, functions, objects.
Contexts	When and where?	Constraints and delimitations.
Means	How?	Procedures, scenarios and interaction structures.
Motives and outcomes	Why?	Goals statements in personas and user profiles.

Use qualities emerge as modifiers to any or all of these components as well as to the usage as a whole. If a use quality is what that characterizes the use of an interactive system, and usage is seen as a system composed of its components, then it follows that a use quality also is what characterizes the composition of the acting subject, the action, the target object, the contexts, the means, the motives and the outcomes.

In interaction design practice, education and research the framework of mediated action can be used to make the inquiries in Table 8.1. This will provide a number of representations and documents that can be used in the design process to describe both that-which-is and that-which-is-desired. In order to produce use qualities, the question of "what the use is characterized by" should be posed to the use as a whole and to all the components. This would provide a list of ques-

tions where "the use" is replaced by a component of the mediated activity system, for example: "The object should be characterized by…"

Sociality of Interaction Design

There is always a sociality to human action. By this I mean that we act within a world, which is socially organized. We act in relation to other people and the artefacts that we use for interaction are socially constructed and they exist within traditions of communities (Leontiev, 1978; Hutchins, 1995; Kuutti, 1996; Coyne, 1998; Wenger, 1998).

To make good interaction design we need to design with this sociality in mind. Artefacts are introduced into communities where other artefacts exist. Users have met similar artefacts before and these meetings form the expectations on the new technology. Design solutions are talked about, advocated and flamed. The values in a community is in the end built into the artefacts so that they provide the perspectives that are relevant to the community, by highlighting objects, features and aspects that is cared about. A new technology must resonance with the community into which it is introduced, while still making the participants in that community happily surprised of the novelty as they recognize something they need, want or desire.

If the technology is in dissonance with the community it will be perceived as useless, wrong, provoking or perhaps even shocking. This can be used to create provotypes that brings fourth the fabric of the taken-for-granted (Mogenssen, 1992). It can also be used for making art, or critical design as Anthony Dunne and others do (e.g. Dunne, 1999).

This implies that interaction designers need to have knowledge of social sciences or at least have a feel for the sociality of the things that they design in order to produce design that works.

Levels of Interaction Design

In activity theory three levels of action are conceptualized: activities, actions and operations (Leontiev, 1978; Kuutti, 1996; Bødker, 1989, 1996). These three levels also have corresponding drivers: motives, goals and conditions. For interaction design, these three levels also emerge as objects for design.

Looking back at the five design patterns for controlling information visibility in co-located collaboration, we see that they are of three

kinds. Firstly, REGULATING PROMINENCE is at the level of activity: it describes what people need to be able to do. Secondly, COMBINATIONS OF MOBILE AND STATIONARY DEVICES is at the level of the artefact: it describes the technological set up of the mediational means. Thirdly, the three CONNECTORS are at the level of the user interface.

All three of these levels of the design objects in interaction design correspond to the three loops of interaction depicted in Figure 1.6, in Chapter 1. The first loop is the interaction between user and artefact. The second loop is between the user and the material that is being manipulated by means of the interactive system. The third loop is between the user and other people involved in the same activity, where the materials and interactive systems are used to mediate.

None of the patterns described in this thesis is corresponding to the level of operations in activity theory, even though the user interface patterns are close. Such patterns could however be constructed for basic interaction designs on graphical user interfaces such as drag-and-drop, click, double-click and mouse-over.

Situatedness and the Un-Controllable Object of Interaction Design

Human action is not static. It is highly dynamic and happens in a stream of consciousness in response to an evolving situation. As Suchman (1987) argued, plans and models are orienting people in their daily affairs rather than controlling them. The same goes for the design of interactive systems. Interaction designers design systems to be used in a particular way. He or she cannot control the situation of use but only provide resources, constraints and perspectives to the user.

Here we can see the interaction designer as a composer rather than a director. The director controls and manipulates what the musicians do; the interaction designer cannot be like that. He or she must instead be like a composer of a musical piece who only writes the manuscript for the activity. The musicians involved then act it out and realize the piece. In order for the composer to see the final result of the piece he or she has to go to the concert. In order for an interaction designer to see the final result of a design he or she must go to the situation of use.

The computer-based interactive system, which is the primary object for design that the designer can directly manipulate, is like the

script for interaction. This is one of the reasons why the words 'composition' and 'compose' is used throughout this thesis. The other reason is that composition brings to mind the design of music, which just like interaction, is time based. Composition also carries the connotation of design as an activity of putting together a synthesis of various parts into a new meaningful whole.

8.2. Multiple Aspects of Use

Given that interaction is dynamic and in a constant flow of events, we could see in the field studies that the character of the interactive system also showed dynamic properties as the use of them shifted focus between aspects.

Dynamic Character

The systems in sociable use were observed to shift character in the middle of usage so that a system could be used as a resource in one moment, a tool in another moment and a medium in the next. If the goals changed so did the character since the object of the activity shifted; the interactive systems displayed a dynamic character.

A consequence of the dynamic character is that there is no dichotomy between medium and tool. Both these characters can be used to describe one and the same system-in-use. This is in accordance with for example Svanæs (2000), Kammersgaard (1988), and Bødker (1996), but stands in contrast to for example Laurel (1993) and also Löwgren & Stolterman (1998) who thinks of it as a design choice of which character to give to the interactive system.

This is an isomorphic problem to the dichotomy of body and mind or physical and symbolical. It is not only the system that is used in a mediated activity that decides the character it will have in use. It is also the purposeful activity through, by and with the interactive system, directed at a set of objects that decide the character. The interaction and its character is emergent from the relation between agent and agency (i.e. the tool). To design a tool or design a medium is accordingly not meaningful, but to design an artefact that acts as a tool or acts as a medium in different situations is meaningful.

Ecological flexibility (Luff, Heath & Greatbatch, 1992), which is the possibility to do different things with the same artefact as needs are extemporaneously presented, can be thought of as the possibility to

shift character at need. For example, a design problem that was encountered in the bank setting was that systems hindered clerks from attending the customer. A solution is to allow users to actively shift character. A clerk, who can decide whether a system should be a common resource with parallel control, a tool with individual control, or a passive resource, can adapt to the current needs of the social situation. The computer technology tends to disrupt and fragment our everyday activities by forcing us to act on objects that are not of our current concern. A user interface that is distributed over multiple devices, such as LOCOMOTION, can potentially solve this by allowing us to place objects that are not of our current concern in the background while focusing on what we care about, for example other people.

In the domestic case, it was observed that users who did not interact with the application lost interest. In order to solve that, two remote controls were introduced, but that led to interference. Again, if users could choose which characters to use at any given time this problem would be solved. Once more, multiple devices are part of the solution. If there are devices where users may individually pursue their own goals whilst being physically close to each other, their goals of entertainment, laid back interaction, relaxation, and togetherness can be met.

The students in the interaction design studio would also benefit from a system where they could control information visibility. In such a system they could instantly move their objects of work from their own screen to another student's screen, to the common table, or to the white-board.

It does seem reasonable that supporting fluent changes of characters would increase ecological flexibility and allow users to reach temporary goals that suddenly appear in sociable activities.

For both educational and practical purposes it is important to remember that interaction designers need to learn how to think in terms of the flow of interactions and in terms of how the use of the interactive system will dynamically change. Not only on the micro-level as described in this thesis but also over the course of several months.

For research processes it is critical to keep in mind, as also emphasised by for example Kuutti (1996), that use of artefacts is never static. A remaining problem that the research community need to confront is

that many of the representations utilized for describing use are quite bad at expressing dynamic nature.

Desirable Use Qualities

The use quality prism in Figure 7.3 (Chapter 7) highlights that every action and every quality carry all the different aspects of use and that choosing to see the instrumental aspects, for instance, is an analytical act of momentarily not seeing the other aspects. It also highlights that the different aspects of use are not to be seen as categories. A use quality or an action can never be said to belong to a certain aspect, it can instead only be said to carry more of one aspect than of other aspects. Previous multiple aspects models of use quality (e.g. Paulsson & Paulsson, 1957; Dahlbom & Mathiassen, 1995; Ehn & Löwgren 1997; Löwgren & Stolterman, 1998) have tended to give this impression. The flow and dynamics of the aspects should be emphasized rather than that there is a certain set of them.

The prism is to be seen as a model for thought that enriches the initial understanding one has of a situation of use by highlighting possible re-interpretations of it in a structured way.

Practicing interaction designers can use the prism to spot the things they have not thought of in the judgements of a design alternative. Especially when the designer is stuck, the prism can work as a force that pushes the design process past the blocking that is in the way. By applying the prism a designer may realize that he or she only has been working on instrumental aspects for several days while not taking social or aesthetical aspects into account. At this point the designer can choose to use another strategy.

The prism can force an interaction design student to take new perspectives on their design problem and hence re-frame it. The teacher can see if a student has a tendency to only consider one aspect when they frame their design problems and make their judgements, and this may help the teacher to spot strengths and weaknesses that a particular student has. When the teacher has pointed out such a tendency to the student the student can use the prism to actively change perspective.

The use quality prism can, furthermore, be used for research into design processes. It can be applied when analysing the judgments different stakeholders in a project make and more importantly, the ones

they do not make. For instance, a graphical designer may focus more on communicational and aesthetical aspects, while a programmer may focus more on constructional issues. A manager may focus on instrumental aspects and a systems developer with a background in participatory design may make more moral judgements. In this way the use quality prism can be used as an analytical framework for critical analysis of judgements in design work.

Use Qualities as Design Objectives

What should one make of use qualities in design work? Firstly, they can be used descriptively. This means that they describe that-which-is. A list of descriptive use qualities can be worked on in workshops and in interviews and to figure out what that is good in a practice and what that is problematic in the practice.

A descriptive list of use qualities tells you how an interactive system is in usage. It can be used for discussion of what that is desirable. This helps in building a language for the design space in which the project team is working.

Secondly a list of use qualities can be used prescriptively. This would describe how the interactive system ought to be in usage. A descriptive list can be turned into a prescriptive list by an act of judgment. The list of prescriptive use qualities can be regarded as design objectives. That is, use qualities to aim for in the design of the interactive system. This conclusion re-emphasizes results by Holmlid (2002) and Howard (2002a, 2002b).

It is imperative in a design project to make clear the motives for design as well as managing the different stakeholders visions in a frank and clearly stated dialogue. For this purpose, use qualities can be viewed as design objectives.

Hierarchical Analysis of Use Qualities

In order to clarify the design objectives the use qualities can be ordered hierarchically using the objectives tree method. As the hierarchy is produced it will become clear that some higher-level objectives are of more important than others. New sub-objectives that can be used to fulfil higher-level will also become clear.

As Cross (2000) notes, different people will draw different objectives trees for the same design problem. This, together with the clarity

and simplicity of the tree, means that it can provide a good basis for discussion in a project team about what to design for. Such a discussion will help the team clarifying the desiderata and more efficiently produce a shared design vision. It is most likely that the detail and understanding of design objectives and sub-objectives will change during the course of design as the understanding of the design situation changes.

When the design process has proceeded into specification, objectives should be so clear that they could be expressed as requirements that later on can be used as criteria for testing.

Purposes that Match Use Qualities

When making a design every element, as well as the whole composition, should strive towards the same design objectives. An element such as a drop-down combobox in a word processor has a form, content and purpose. The form and the content should contribute to the purpose, which in turn should contribute to the desirable qualities that the system shall display in use. In the example of the drop-down combobox, it has a form of WIMP-interfaces (Windows, Icons, Menus and Pointers) with text and drop-shadow graphics as medial forms and it has an interactive form that is a click at which a scrollable list box appears. It contains a label, an editable text field (where text is interpreted) and a button. The purpose of it is to provide the functionality of easily choosing format in the word processor, while showing what is chosen, communicating its function, providing overview of available formats, and showing what the consequence will by of applying it. These purposes of the specific element in the entire composition of the word processor match the overall desirable use qualities of it. The use of the word processor should, for example, be characterized by easy access to often-used functions, understandability, overview of available alternatives and feed-forward information of the consequences of choosing an alternative. The design of the drop-down combobox for choosing formats contributes to all of these qualities in the use of the word processor as a whole.

This approach of systemic analysis of parts and their relations to each other and to the whole, based on the purpose of the parts is promising for analyzing user interfaces and for connecting this analysis to the role of the entire interactive system in use. Given that desirable

use qualities have been identified, the process of choosing among design alternatives will become more transparent and the design rationale easier to follow without further overhead.

In practice the hierarchical analysis of the interactive system will probably be too explicit and time consuming in most design projects. The systemic kind of thinking into elements of form (medial and interactive), content and purposes (that contribute to desirable use qualities of the whole) may, however, be important when making artefact analysis, and when comparing two systems and also when judging their fitness for purpose. Together with an analysis of style it could in fact become an important part of interaction design research methodology.

8.3. Interaction Design Patterns for Sociable Use

Four use qualities were identified as desirable in all three sociable situations of use: participation, autonomy, politeness and extemporaneity. These four will be important to design for in all situations where people are co-present and face-to-face, and they can perhaps also be transferred to geographically distributed situations of use.

The four desirable use qualities were then utilized as forces in the set of design patterns for controlling information visibility. The patterns were identified as being of different kinds: *activity patterns*, *artefact patterns* and *user interface patterns*. As mentioned before, these levels correspond to the model of interaction design as the design of interactions with, through and by means of interactive systems. This categorization of the patterns makes it easier to connect them to existing pattern languages such as those by Tidwell (1999; 2004), by van Welie (2004) and by Martin et al. (2001, 2002).

As illustrated in the design patterns presented in Chapter 6, desirable use qualities can function as forces in a design pattern. This means that traditional qualitative research, making use of methods of analysis like concentration and categorization, can be used as empirical ground in the development of meaningful design patterns in HCI, CSCW and interaction design.

The consequence for educating interaction designers is that they would benefit from a dose of qualitative research method in order to develop and document design knowledge in the form of patterns.

Conflicts between the use qualities can be highlighted in a problem statement, and further analysis of situations that do not have the conflicts can provide grounds for the solution statement of the pattern. This approach to documenting design knowledge fits well with developments in ethnographically informed design (e.g. Hughes, King, Rodden & Andersen, 1994). Use qualities as competing forces is not an entirely a new idea. One can trace it in the claims analysis of scenario-based design (Rosson & Carroll, 1995) as well as in the questions-options-criteria notation of design space analysis (Maclean & McKerlie, 1995). However, no previous research has made the explicit connection between desirable use qualities and design patterns.

A problem when generalizing over three very different cases to create a generic design pattern such as REGULATING PROMINENCE is that there is a risk of creating a vague pattern since it becomes unspecific due to loss of detail. Design situations are unique situations and patterns should therefore be used with some care in a design process, contextual factors may have a very large impact on which design solutions that are appropriate. An example of that can be taken from the bank case: What if LOCOMOTION was taken into use there? Would the customer then start to think about what the advisor has on his or her screen, since there is some information that the customer gets to see and some that only the advisor gets to see? Would this ruin the customer relationship? We do not know—it is an empirical question, but it is an example of how context dependent the realization of design patterns is.

One should therefore read patterns as inspiration and reminders that must be applied with judgement rather than as rules. Inexperienced designers will probably find them more rewarding to use than experienced designers will.

8.4. Reflections on Method

During the work on this thesis a number of reflections have surfaced on how to do qualitative case studies in design research. Some reflections concern the relationship to participants, other concern the role of theory.

Validity of the Results

The desirable use qualities are based on thorough empirical work in three settings, and were then concentrated, categorized and related to theories and previous research in socio-linguistics and anthropology. The four qualities can almost be regarded as universals in human-human interaction and traces of them can be found in many sources of research. This makes the claim for the four qualities in sociable use of interactive systems quite solid.

The dynamic character was observed in all three cases and stems from the extemporaneity and situated nature of human interaction. This result is supported both by empirical material and theory of human cognition.

The design patterns are based on experience from design work as well as on observations of physical and computer-based information systems that worked in the three settings. It is also supported by the many different systems that has been developed within the CSCW research community that implicitly implement the patterns.

The various models for thought that has been refined and developed throughout this thesis is in turn based on the analysis of the empirical material in the light of socio-cultural and phenomenological theory in combinations with design theory. The applicability of these models will need further testing in other design domains and in the practice and learning of interaction design.

Good for Who?

When talking about use quality the question that often arises is: "Good for who?" In the case of the bank, the main perspective that was taken was that of the clerk. The customer has been taken into account only in relation to the work of the clerk. The organizational and management perspective have been restricted in the same way. This means that the focus has been on the work situation of the clerks and this has been contextualized towards management, organisation and customers. The perspectives of customers and managers have hence not been actively taken.

In the studio it is foremost the work of the students that has been focused and hence it is also their perspective that is portrayed in the empirical material. The teachers' perspectives only enter as contextualization to the perspectives of students.

In the case of multimedia platforms in the home, it is the perspectives of users that are described. Producers' perspectives are for instance not taken, but they have still influenced the research in the choice of topic as well as in the choice of what prototypes to try out.

Methods for Gathering Empirical Material

Looking back on the research method behind this thesis, much of the empirical work was based on situated interviews. A deeper understanding would have been developed if the situation of use could be studied in its own context, within a stream of events and developing interactions it is in participant observation (Becker & Geer, 1957).

The problem with interviews is that the researcher cannot easily re-affirm an understanding. In the bank case, this was managed by the interpretative workshops. 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 informants were not aware of.

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

> …the definition […] will include those projects in which researchers 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.

Duration and frequency of contact as well as quality of the relationship between the researcher and the informant is what defines an

interview as ethnographic. 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 be made in relation to the meaning of the actions and events under study in the actual life-worlds of the participants. These key characteristics are what sets ethnographic studies apart from survey studies.

The interviews conducted in the homes of people, the workshops at the bank, and the observations in the studio can be regarded as ethnographic since there were on-going relationships to the participants where a good understanding of their life-worlds could be developed. In the prototyping sessions and in the fieldwork at local bank branches there was no real time to develop this deeper understanding and the interpretative validity of these sessions are smaller than those of the other research activities. They can, instead, be seen as a triangulation of the results from the other activities. The fieldwork at the bank provided material for workshops and allowed us to check the interpretations made by workshop participants, and the prototype tests and prototype-primed interviews allowed participants to be confronted with the technology of tomorrow at which new things were learned.

The Role of Theory

When describing the design process and the rationale for taking certain design decisions, it is easy to fall into the trap of introspection instead of reflection. Introspective stories of what happened and of the experiences that you had are often without validity outside the report. Reflection driven by theory is on the contrary valuable to others and a valid approach to doing design research. The theoretical constructs make the researching designer into a stranger to the design situation and help him or her to take a step back and scrutinize the process from another perspective. As argued in Chapter 3, it is theory, guiding the focus in observation and categorization that makes the research case different from anecdotes.

The work in this thesis is characterized by theoretical eclecticism. This means that no single theory is put to test. Instead the research draws upon several theories to describe, discuss, and guide empirical work as well as design work. This approach is preferred in case study-based design research since the case may involve analysis of tradeoffs

in the design work that cannot be dealt with from a single theoretical perspective.

8.5. Future Research

Several issues remain for future research. It is especially important to direct research efforts at the practice of interaction design to ensure the usefulness and relevance of the research.

There is for example a large potential for scenarios to be used when describing forces in design patterns to make patterns and specifically the conflicting forces come alive for a design team. It also seems appropriate to relate the claims analysis in scenario-based design (Rosson & Carroll, 1995) to the desirable use qualities in the situation, and hence to the forces in a design pattern. This is however only a working hypothesis at this time and future research on the issue in the interaction design practice can say if it holds or not.

Another direction for future research is to look into the efficacy of interaction design patterns on design work in both educational and professional settings. One property of a well-written design pattern is that it is communicable and debatable and to be that it must be clearly stated. This should be empirically tested in practice. The same kind of reasoning also holds for other models for thought like, for example, use quality design objectives.

As highlighted by the constantly shifting character, the use of interactive systems is highly dynamic. A problem for future research to solve is that the design representations that are used today are quite poor at expressing this dynamic nature. For example, scenarios are linear representations that do not express the dynamic and extemporaneous nature of sociable situations of use.

This thesis has treated models for thought in an analytical and constructive manner. Future research needs to focus on the models that are used for thinking in practice today, how and why they are used and not used, and what they reveal and hide from the interaction designers in that practice. I have in previous work taken steps in that direction (Blomquist & Arvola, 2002), but more research like that is needed to make a more substantial contribution. That can be achieved by placing the starting point of the research in the everyday work of practitioners looking at their knowing-in-action.

Given the current trend towards ubiquitous computing and handheld devices as well as computing technologies built into everyday artefacts, there is, in design research, a need to explore the relationship between interaction design and industrial design. Edeholt and Löwgren (2003) argue that the areas of knowledge between the two professions are complementary and for businesses that work in consumer electronics as well as in ubiquitous and embedded computing, an interdisciplinary approach is needed. Contemporary industrial design includes, according to Edeholt and Löwgren, the basic skills of meeting both the wishes of manufacturers and those of general users; exploring new possibilities; and communicating them in visual and tangible ways in the design of three-dimensional and physical products.

Interaction design as the design of interactions with, through and by means of an interactive system is quite different from industrial design in that it needs to focus on the dynamics, flow and tempo of human activity. The interactive system can be pro-active and change character swiftly, and the design objects (activity, mediating artefact and user interface) are dynamic and partly uncontrollable.

Future research that integrate the theoretical and practical aspects of the two disciplines in the design of physical-digital products will in light of their differences be very interesting reading.

8.6. Contributions

This thesis has provided a set of units of analysis and models for thought based on a socio-cultural history of ideas to be used in interaction design. They have been refined and put to test by empirical work in sociable situations of use, and they should in the future be carefully put to test in other kinds of use situations. The models can be useful in interaction design practice, learning and research for articulation, highlighting and reflection of shades of use. The overarching contribution of this thesis is that it expands and refines design theory and design patterns in the interaction design domain by empirical work. The connection between empirical material and socio-cultural theory and the notion of mediation, gave the basic units of analysis for interaction design as design of mediation: activity of use, mediating artefact and user interface.

Interaction Design as Design of Mediation

Interaction design is the design of the interaction with the product, through the product, and by means of the product. The designer does, however, not finalize the interaction. It is instead in usage that the interaction is realized and decided. *The interaction designer provides users with perspectives, resources and constraints on the space for actions*. That is, the designer forefronts some things ready for action and places other things in the background. The user then enters the perspective that the designer has given him or her and modifies it according to current motives and directing it at objects of care. The interaction design is not fully realized until the user engage in action. *The interaction designer is hence like a composer* who writes the scripts to be acted out, but who cannot control the end-result. This means that interaction design deals with second-order design problems. The interactive system is the object of the first order that is being manipulated, but the designer also aims at changing the use activities that are of the second order. It follows that the design object for interaction design can be described at three levels: *the user interface and the interaction with it*, *the mediating artefact as a means for action* and the *activity of use directed at materials and people.*

Multiple Aspects of Use

Desirable use qualities were identified in workshops, interviews, and observations with users as well as in design work. It was demonstrated how these can be enriched and articulated upon by refracting them through the *use quality prism* do disclose their *instrumental, communicational, aesthetical, constructional* and *ethical aspects*. They were furthermore hierarchically organized to further clarify them as *use quality design objectives*. These objectives can then be used throughout the entire design process, from vision to testing, as means for communication with stakeholders and for communication within the design team, as well as for directing the design effort to compose a complete whole that works. Stating use quality design objectives can, furthermore, help by making the design rationale clearer without further overhead, by setting assessable quality indicators, and by increasing the comparability between design solutions.

Interaction Design Patterns for Sociable Use

Four critical use qualities to design for in sociable situations were identified: *participation, autonomy, extemporaneity,* and *politeness*. From the extemporaneity of the sociable situation of use follows that design solutions that have a *dynamic character* (e.g. can shift between being used as a resource, tool or a media) and can provide ecological flexibility facilitate good interaction in sociable situations of use. Users need to be able to *control the visibility of information* and this can be achieved by implementing the design patterns REGULATING PROMINENCE, COMBINATIONS OF MOBILE AND STATIONARY DEVICES, DROP CONNECTOR, GO CONNECTOR and SEND CONNECTOR.

The empirical work show that *desirable use qualities can be used as forces in design patterns*, which means that traditional qualitative research is very valuable when documenting design knowledge in the form of design patterns.

Design patterns for HCI, CSCW and interaction design can be described on the same three levels as the design objects for interaction design: *user interface patterns, artefact patterns*, and *activity of use patterns.*

8.7. Conclusion

The aim of this thesis has been to provide and specify units of analysis and models for thought in interaction design for sociable use. It has done so in the areas of 1) interaction design as design of mediation, 2) multiple aspects of use, and 3) interaction design patterns for sociable use. All of the models for thought work as different pairs of shades that disclose different aspects of the world. Exchanging shades with each other and articulating what is disclosed will provide food for thought in the interdisciplinary endeavour of interaction design.

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Glossary

artefact Something that is a product of human action. It can be both mental like a concept or a procedure, or it can be physical like a hammer. A cognitive artefact is an artefact that is used for cognitive purposes, as for example a memory aid or a highlighting that draws attention to it. A design artefact is an artefact produced during design, e.g. a sketch or a prototype.

aspect A particular appearance of an object as it is regarded from a certain perspective.

character The character of an interactive system in use is a relatively stable set of qualities of the actions that the system is designed to mediate. When taken together they form a coherent entity. When the character works, it fulfils its technical functionality in action, it has qualities that match the actions it mediates, and it also has logical connections between its technical functionality, its qualities and the actions that it mediates. Finally its qualities do not change arbitrarily, but when they change momentarily for some reason it can be said to change mood.

computer-supported cooperative work (**CSCW**) The research area of how people work together using computer technology and how to design computer technologies to support cooperative work. Such technologies are often referred to as groupware.

design The process of intentional exploration of the conceivable futures of the situation at hand to initiate desirable change. Explorative moves are made in models of the world in order to assess the consequences. The models are by necessity externalized by means for expression such as talk, sketches, graphs and other design artefacts. It can also be the product of such a process. The material, which that product is made out of, is called the design material.

design objective The starting point for a design process is quite ill-defined and requirements are vague. In order to structure the work designers need to aim at achieving some end. That end is a number of design objectives.

design pattern A description of a certain context, where a system of forces occurs repeatedly, and a certain configuration of features that allows these forces to resolve themselves. Recurring conflicts between forces are put as a design problem and the configuration of features that resolves the potential conflict is put as a generic but readily identifiable solution.

force In a design pattern, the needs, fears, desires, goals, wants, restraints and constraints (human, social and physical) that characterize a situation and affects our life. It is a metaphor to molecular dynamics where a force field refers to functions and parameters that describe the interactions of vectorial forces acting within systems of particles. In terms of design patterns, a situation without inner contradictions between forces is regarded as a good situation.

human-computer interaction (HCI) The research area of design, evaluation, implementation and study of interactive computing systems for human use.

interaction Action that is performed mutually and reciprocally in close contact between several parties. In the case of human-computer interaction, at least one party is human and at least one is computer-based.

interaction design Interaction design is the design of the interaction with the product, through the product, and by means of the product. The designer does, however, not finalize the interaction. It is instead in usage that the interaction is realized and decided. The interaction designer provides users with perspectives, resources and constraints on the space for actions. That is, the designer forefronts some things ready for action and places other things in the background. The user then enters the perspective that the designer has given him or her and modifies it according to current motives and directing it at objects of care. The interaction design is not fully realized until the user engage in action. The interaction designer is hence like a composer who writes the scripts to be acted out, but who cannot control the end-result. The design object for interaction design has, according to a mediated perspective, three levels: the user interface, the mediating artefact and the activity of use.

interactive system A computer-based system that allows for interaction through, with and by means of it.

judgement The act or activity of forming an opinion or assessment by discriminating and comparing. It can also denote the capacity for forming an opinion about something through careful weighing and testing of arguments

means Something that lies between and mediates. It is, in this thesis, often used to denote an artefact that is used to reach a desired end or fulfil a purpose.

mediated action An agent acting with mediational means for reaching a complex of goals. In mediated action there is an irreducible tension between the acting agent and the means.

model for thought A simplified representation used for structuring thinking about the object which is represented. It is a help for visualizing, reflecting on, and understanding consequences of things that are not directly observable, but also used to stimulate dialogue between people.

object Something mental or physical towards which action, thought or feeling is directed at.

perspective A direction towards the world so that some objects or aspects are in focus while other objects or aspects are in the background. This direction provides a point of view from which the objects or aspects are considered.

sociable use Situations where several people use technology co-presently, face-to-face while engaged in joint activities.

subject An agent or actor with feelings, thoughts and consciousness.

system A set that is made up of parts that interact in non-simple ways. It is composed of at least two components and a relation that holds between each of the components and at least one other component in the set. The functions of the components must be understood in relation to the purpose of the whole set, which is what makes the system meaningful.

use The activity of users acting by means of artefacts for reaching some goals at a certain time and place. It is in this thesis thought of in terms of mediated action. Use consists, accordingly, of the irreducible tension between acting subject and mediational means performing purposeful actions directed at some object to reach a desired outcome within a certain context.

use-orientation In design, aiming at understanding and designing for the activity and practice of using artefacts.

use qualities That which characterizes the use of an artefact in terms of distinguishable attributes, features, properties, characters and traits. Also called qualities-in-use, with or without hyphens.

Populärvetenskaplig sammanfattning

Datorer i vårt sociala samspel: Interaktionsdesign är att erbjuda möjligheter att agera.

Datorer används i sociala situationer, som exempelvis kundmöten eller hemma i soffan. Detta tas sällan hänsyn till i designarbetet vilket betyder att datorer ofta är till besvär i samspelet mellan människor. Den här avhandlingen ger perspektiv på sociala användningssituationer och verktyg för att kritiskt granska och lösa interaktionsdesignsproblem i design för social användning av datorer. Datoranvändning har i denna avhandling studerats i kundmöten, designstudios och hemmiljöer. Studien visar att folk behöver utföra individuella handlingar samtidigt som de agerar gemensamt, på ett spontant sätt men också med hänsyn till varandra. Sociala situationer är föränderliga och datorn måste kunna användas på olika sätt och låta brukarna styra vem som har tillgång till vilken information. Dagens persondatorer kan inte erbjuda denna typ av dynamiskt samspel och i avhandlingen föreslås ett nytt sätt att förstå datorns design i sociala situationer. Detta konkretiseras i en multimedia-anläggning för hemmabruk, Locomotion, som består av både mobila och stationära enheter. En sådan designlösning erbjuder möjligheter att agera, men låter brukarna själva realisera hur samspelet ska gå till.

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Dissertations

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