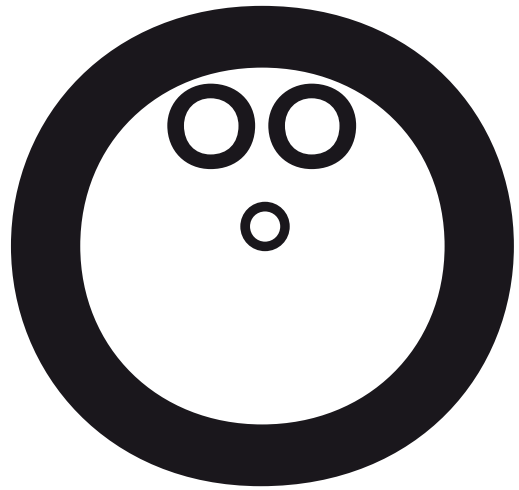
PROTO TYPING SOCIAL ACTION

Esko Kurvinen



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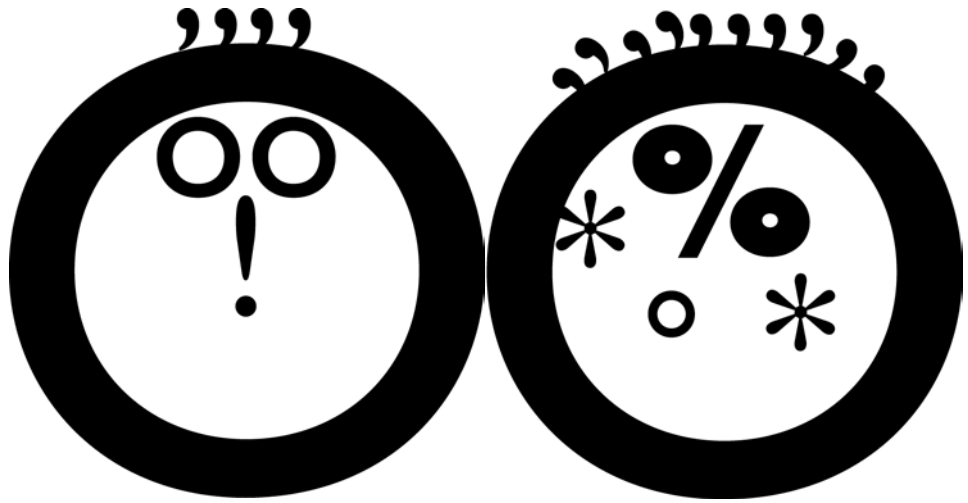

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Esko Kurvinen

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Helsinki, Finland
March, 2007

PROTO-TYPING SOCIAL ACTION

ESKO KURVINEN

1. INTRO-DUCTION

1. INTRODUCTION

1.1 The problem of social action

Recent changes in information technology have made social interaction an increasingly important topic for interaction design and technology development. Mobile phones, PDAs, games and laptops have eased interpersonal communication and brought it into new contexts like bus stops, trains, cars, and city streets — in fact everywhere people find themselves and move about. In these situations, the old paradigms of one person interacting with technology, or a group at work in an office or collaborating over a shared system are inadequate in guiding the design of such systems.

These technologies represent new challenges for interaction design, which has inherited its methodological baggage mainly from three sources, none of which specifically focuses on how ordinary people use social technologies. Usability research and human-computer interaction (HCI) seldom quote sociological theory in their premises.[1] While research in computer-supported collaborative work (CSCW) has increasingly focused on questions beyond the workplace, the basis of this field of study still stems from workplace studies in which social organization is devised to support work tasks rather than ordinary activities.[2] New articulations of methods and frameworks are required for understanding and designing interactive technologies for social interaction in ordinary activities.

The main problem in studying social action for design is not the lack of methods, but the approach: how should circumstances for social action to happen be created, how should it be observed, how should systematic, detailed inferences about it be produced for the purposes of design, and what design-related activities does such research serve? In this study, ethnomethodology (EM) and conversation analysis (CA) provide a perspective for seeing structure in social action. As will be shown, without a proper and tested framework social action is a slippery topic. The main contribution of this study is that it articulates how this framework can be brought into design studies. This study also demonstrates empirically that this approach works.

1.2 The articles

The articles of this dissertation appear below, not chronologically, but in thematic order:

- Article 1 “How industrial design interacts with technology: A case study on the design of a stone crusher” (Kurvinen 2005)
- Article 2 “Emotions in Action: a Case in Mobile Visual Communication” (Kurvinen 2004)
- Article 3 “Only When Miss Universe Snatches Me: Teasing in MMS Messaging” (Kurvinen 2003)
- Article 4 “Towards socially aware pervasive computing: a turn-taking approach” (Kurvinen and Oulasvirta 2004)
- Article 5 “Are You Alive? Sensor Data as Resource for Social Interaction” (Kurvinen, Lähteenmäki, Salovaara and Lopez 2007, forthcoming)
- Article 6 “Prototyping Social Interaction” (Kurvinen, Koskinen and Battarbee 2007, forthcoming)

Article 1 is based on the domain of workplace studies or CSCW. In this respect it is somewhat different to the other texts.[3] While Articles 2 to 6 are about prototyping social action, i.e., prototypes and prototyping that enable social action, Article 1 is about social action that is organized around design concepts, virtual prototypes and other representations suggested during design meetings. As such, Article 1 serves as an introductory article to the research approach and its origins. Ethnomethodology and conversation analysis are best known to the wider research community for their practical applications in the domains of institutional interaction, workplace studies and CSCW. Article 1 follows this tradition, in particular as it is about meetings that are at the heart of knowledge-intensive work (Koskinen 1999; Boden 1994). Furthermore, the study serves as an introduction to the domain of industrial design. In contrast to the popular view, which mystifies design and the emergence of innovations, the article takes industrial design as a practical, co-operative and multidisciplinary enterprise that can be observed, dissected and analyzed. The enigmatic nature of design work is not an excuse to gloss over it in vague terms, but a call for detailed and transparent analysis.

Articles 2, 3 and 6 are about mobile multimedia in consumer use. Article 2 is from the Mobile Image study, presented in more detail in Koskinen at al. (2002; published 2001 in Finnish). The article takes the immensely popular idea of emotions attached to products, offering an alternative approach to the product-human relationship in light of the Mobile Image data. According to

this view, how we feel about products and services in general or at some specific moment is the result of a time-consuming social and collaborative process. The article shows how this process can be scrutinized. The examples presented in the paper illustrate the retrospective-prospective reflection and collaborative meaning making relating to mobile images.

Article 3 is based on an MMS pilot study that was a logical continuation of the Mobile Image study. The contribution of the article is twofold. First, it is a programmatic call for taking interaction as a *topic of analysis* instead of using it as a *resource* for studying things that are external to the activity itself. Second, analysis of the examples follows this call by focusing on an engagement announcement that was followed by two types of elaborate yet routinized responses, congratulations and teases. Although the examples are unique, they are not anecdotal as they call into question the notion of mundane and established patterns of interaction, as presented in previous research on mobile messaging. That is, routine interactions do not so much pre-exist just waiting to be instantiated, but their normative content and structure are available to participants as they make sense of and construct the event and experience they are part of.

Articles 4 and 5 are from the area of context aware, pervasive or ubiquitous computing. In contrast to other articles, we are now dealing with technology that is complex, highly connected and relatively immature at present. Article 4 starts from the popular notion that future systems will be able to distinguish between different types of social situation and act respectfully to what is expected or not in these *contexts*. Logically, the prerequisite for telling what the contexts are about is that the system should be able to recognize when shifts between different contexts take place. To better understand what happens at such moments, we took three real-life examples of human-made invitations to participate in an event (i.e., *context*). The analysis points out the importance of dynamic and constructive factors over static and currently measurable context variables that most developers focus on. Furthermore, the paper questions the fundamental idea of explicit borderlines between contexts by showing that considerate negotiation and the designed vagueness of the human-made invitations serves many other purposes beyond the initiation of some event.

Article 5 is about a prototype that was used to collect personal, health and performance related sensor data and share it via mobile devices. While mainstream context awareness is about systems abstracting raw context data for the benefit of the user, our analysis focused on how people themselves made sense of this data when it was offered to them. In a setting that consisted of teenage football players being monitored and their parents looking at the data, we observed how the system became a social catalyst for *social chit-chat* beside the

field. Our implications include features and guidelines for the system concerned, as well as design drivers beyond its immediate scope.

Article 6 is a summary article on our angle on prototyping that involves social, i.e., interpersonal interactions. In the domain of design, earlier writings discuss prototype fidelity (e.g., the cost-benefit ratio) or the role of prototypes as sources of inspiration or as integrating elements in multidisciplinary design teams. In contrast to these, we argue that the role given to the user distinguishes best between possible orientations to prototyping. The framework or paradigm offered does not imply a particular theoretical orientation, or exclude the orientations above, but, most importantly, enables well-tried empirical approaches from the domain of the social sciences.

The data discussed in the articles comes from six different studies or projects, listed chronologically below.[4]

- 1999-2001: Mobile Image study (Articles 2 and 6)
- 2001-2002: Between project (Article 4)
- 2002: Wireless Imaging study (a part of Article 6)
- 2002: Radiolinja MMS Pilot study (Articles 3 and 6)
- 2002-2004: Proomu project (Article 1)
- 2004-2006: IST MobiLife project (Article 5)

This list reflects the personal working history of the author, between two universities, funded by national and European agencies and companies with various interests. Despite the variation across datasets and projects, the research conducted is based on one theoretical and methodological framework. This demonstrates that the approach is flexible and effective as it carries across different types of environment, organizational conditions and research projects with diverse objectives and focus.

The present approach is not a general sort of orientation, but is structured and well-tested in the social sciences, its key elements being routinely taught at universities. Although it is a niche within the social sciences, it focuses precisely on the issues industrial design and the design of interactive systems are concerned with.

2. USER-CENTERED DESIGN AND SOCIAL ACTION

2. USER-CENTERED DESIGN AND SOCIAL ACTION

2.1 UCD and usability

User-centered design, also called human-centered design (ISO 1999), is a research and product development orientation that utilizes end-user or customer information for making better (efficient, usable, enjoyable, etc.) and thus commercially successful products. In practice, this is achieved by involving the end user in the product development process.

Gould and Lewis list the key principles of UCD, dating back to the 1970s:

- "**Early Focus on Users and Tasks.** First, designers must understand who the users will be. This understanding is arrived at in part by directly studying their cognitive, behavioral, anthropometric, and attitudinal characteristics, and in part by studying the nature of the work expected to be accomplished.
- **Empirical Measurement.** Second, early in the development process, intended users should actually use simulations and prototypes to carry out real work, and their performance and reactions should be observed, recorded, and analyzed.
- **Iterative Design.** Third, when problems are found in user testing, as they will be, they must be fixed. This means design must be iterative: There must be a cycle of design, test and measure, and redesign, repeated as often as necessary."
(Gould and Lewis 1985: 300)

Similarly, ISO 13407 (ISO 1999) presents human-centered design activities as an iterative process that consists of user studies, specifications, design solutions and evaluations.

Term *usability* goes hand in hand with UCD. Depending on the context, usability means different things.

- First and perhaps most often, usability is referred to as a measurement. ISO 9421-11 (ISO 1998) defines usability as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction. In addition to effectiveness, efficiency and satisfaction, other components that make up the overall usability measurement, have also been outlined (see Keinonen 1998; Säde 2001).
- Second, usability can be seen as an attribute of the product (Keinonen 1998). This means that products have properties that delineate or affect how the user experiences their use.
- Third, from the perspective of product design, usability can be seen as sets of checklists, guidelines or heuristics to follow during the process (Säde 2001). For example, Nielsen (1993) provides a list of ten usability heuristics, things to take into account when designing interactive products.
- Fourth, usability literature provides not only things to measure but also methods and techniques for measuring (Rubin 1994; Säde 2001).
- Finally, practical methods and techniques are not enough. Their benefits are realized better when supported by organizational programs, usability strategies and milestones (Rubin 1994. 297-312).

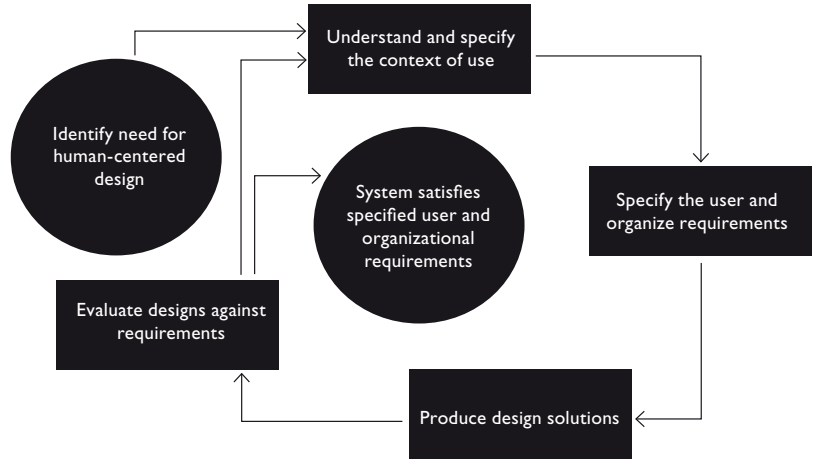

Figure 1: The interdependence of human-centered design activities (ISO 1999)

Seeing usability as a personal and organizational incentive for end-user involvement in product development brings it close to the idea of user-centered design. Indeed, as pointed out by Keinonen (1998), usability and user-centered design are often used synonymously.

Instead of usability, in this book, I have used user-centered design (UCD) as the umbrella term, under which several techniques for creating better, user-friendly products can be located (Rubin 1995: 11). There are historic reasons for this. Usability is strongly associated with interactive products, i.e., devices whose user interface consists not only of a physical part, but also of software. However, within industrial design and product development in general, focus on the consumers and their doings had been around since before the breakthrough of the microchip (Säde 2001; Battarbee 2004). It has also been suggested that there are some substantially problematic issues in the usability approach. Since the nineties, some practitioners in design and research have actively distanced themselves from the usability concept.

2.2 Beyond usability, the new school

The *beyond usability movement* (Jordan and Servaes 1995; Blythe et al. 2003; Battarbee 2004) sees traditional usability as a performance-oriented approach which fails to take the broader issues that relate to human-product relationships into account. The problem is not that the definitions, guidelines and so on, outlined within usability do not match the new approach. Usability literature indeed provides extensive lists and hierarchies of important issues, including all the emotional, subjective, social or context dependent aspects that the beyond usability movement also considers important. For the new camp, the problem resides what not so much in the definitions (Blythe and Wright 2003: XVI) as what they see usability is in practice.

The basic old school usability is about seeking problems people have with particular products (Keinonen 1998). This is fine as long as we have products to test, but less useful when designing experience-rich interactions (Battarbee 2004: 8-9) or anticipating the use of some as yet non-existent product (Koskinen and Battarbee 2003).

Three key themes have emerged from the new school:

- Design for user experience. The key objective is to provide people with experiences created or mediated by products and services.
- User inspiration. Designers can be inspired about the doings or the users and material they produce.
- Empathic design. We need deeper understanding of the users. We need to know them as individuals.
- Hedonism. People seek pleasure through products[5]

Sanders and Dandavate summarize the objectives of the user experience approach: if we can learn to *access people's experiences* (past, current and potential), we can make user experience the source of inspiration and ideation for design (Sanders and Dandavate 1999: 88).

Inspiration is the key word here, although it is by no means new. The idea is analogous to the traditional or popular view of design as a designer-driven creative activity. Just as Tapio Wirkkala was inspired by the Lappish environment, its shapes and colors (Pallasmaa 2000) in the golden days of Finnish design, today's interactive device, application and service designers are inspired by the doings of the people and design is based on that inspiration.

The user inspiration approach does not require understanding (in some objective or scientific sense) of what the users do. *Cultural probes*, originally developed by Gaver, Dunne and Pacenti (Gaver et al. 1999), is one widely-used method for this purpose. In the original version of probes, subjects are provided with self-report packages, cameras, diaries, etc. for few days or weeks. The material collected is not so much analyzed as used as a backdrop in design sessions (Gaver et al. 1999). The process itself relies heavily on the insights of the designers, making it possible to empathize with the life of the subjects, but provides no means to assure that empathy indeed occurs. Nevertheless, this is not an issue insofar as the key objective is to unleash the creative potential of the designers. The material collected and used is only of secondary interest as the quality of the process is evaluated in terms of the designs produced.

Although the user inspiration approach may be efficient in generating design ideas, it is not always user-centered (Koskinen and Battarbee 2003). To bring credibility and structure to empathy, one can borrow from the methods and approaches of other sciences. Mattelmäki (2005) updates probe methodology to ensure a better fit with industrial context. Probes are combined with interviews that focus on issues researchers identified in the material probed (Mattelmäki 2005). This results in user inspiration that is combined with inference, bringing the research closer to the qualitative social sciences (Koskinen 2003a). Hutchinson et al. (2003), who also combine interviews and probes, stress the importance of technological input, distinguishing between *cultural* and *technology probes*. They see this approach as combining *social scientific, engineering* and *design goals* (Hutchinson et al. 2003: 18).

Interviews and self-reports provide only second-hand information on the users' actual interactions with products. This is widely recognized within the discipline. A survey of method usage among UCD practitioners shows that *field studies,* including *contextual inquiry* (Beyer and Holtzblatt 1998), are considered most important for the practice (Vredenburg et al. 2002). Among many others, Jane Fulton Suri stresses the importance of observation, looking at what people

really do. She argues that to ensure human-centeredness, it is better for the design teams to discover the significant issues for themselves, rather than just be told about them (Fulton Suri 2003: 54).

For Fulton Suri, mere observation is not enough, since it needs to be complemented by *empathy* in order to access people's thoughts and feelings. According to Fulton Suri, the inner states of the user are of most importance to designers. She defines empathy as something we all intuitively master (Fulton Suri 2003: 53). This implies that it may not be possible to turn *empathic design* into a systematic research approach. Fulton Suri also recognizes some inbuilt problems with this approach. Precisely because relating strongly to another person's feelings may cause bias, she suggests we should complement subjective empathy with objective observation (Fulton Suri 2003: 53).

2.3 Sensitizers for complex problems

The key contribution of the *beyond usability school* is that it pushes designers to reconsider and reinterpret products and their use from various angles. Much of this work focuses on providing *sensitizers for complex problems*. The background observation is that all products are multi-faceted and that this complexity should be taken into account when designing products and services. While making even some of this complexity known to designers is most valuable, the challenge is whether any of this can be turned into a structured research approach. This may be difficult, since, within the design discipline, *ambiguity* and *openness* are often preferred over *knowing* (Sengers and Gaver 2006). In design-driven processes, the idea is not to come up with some ultimate truth about the relationships between products and people, but to provide a richer view or product use and generate ideas to drive the work.

Several frameworks have been proposed for this purpose, offered as sensitizing concepts, checklists of things one should look for in studying the users and designing products and services. Battarbee (2004) puts user experience frameworks into three categories:

- Person-centered frameworks: what people need
- Product-centered frameworks: design and research checklists
- Interaction frameworks: focus on action

The last category is especially relevant to interactive systems, be they traditional human-computer interaction or related to systems that connect people to each other. This is also acknowledged by the user experience or beyond usability school. For example, pleasure, as argued by Jordan, is not an attribute of the product, but a property of the interaction between a product and person (Jordan 2000: 12). Some authors even point out that interaction is the most crucial thing in experience design. Sanders (2003) and Sanders and Dandavate (1999) assert that experiencing is a constructive activity, and that experiences cannot be designed directly. Similarly, time matters for Forlizzi and Ford (2000), who argue that experiences with products relate to events that have some beginning and end. Thus, experiences also make storyable objects that can be shared with other people (Forlizzi and Ford 2000).

Battarbee, drawing from the pragmatic philosophy of John Dewey, adds to the frameworks above, introducing the concept of *co-experience*. The missing element, as she points out, is that people not only use products together, but also use them in order to share and create meaningful experiences with each other (Battarbee 2004). Like her predecessors, Battarbee stresses general principles over the actual methods used, providing a *sensitizing framework* towards the co-operative or social aspects of product use. This includes treating people as authors of their own experiences, as creative actors who are engaged in interaction with each other (Battarbee 2004; also see Article 6 in this book).

The user experience frameworks are typically so generic that they do not clash but add to what others have already proposed. Typically, this is done by pointing out some neglected point of view from previous work and adding the missing parts. Unfortunately, while the checklist grows as a result, theoretical and methodological awareness does not.

2.4 The critique of *traditional HCI*

Interactive system researchers and designers are in need of an appropriate theoretical grounding for their work (Dourish 2001). But where does one look? The obvious domain to draw from has been cognitive science driven HCI. For historic reasons (see Sections 2.1 and 2.2 above) there still is a strong psychological and individualistic undercurrent in academic HCI and UCD research. This is apparent for example in the objective of locating emotions, attitudes or other meanings inside the heads of the people studied. Where social aspects are of interest, the focus is typically on the outcomes of interactional and social processes, neglecting their procedural features. For example, *social functions* are listed, but analysis does not explain how they were achieved by the participants (Article 3). Furthermore, selection of cases seems to rely on implicit moral assumptions about user experience. For example, product-related emotions are mapped on a bipolar positive-negative scale, and from this angle it is difficult to address frequent, ordinary and routine actions and activities.

Mainstream HCI draws from information-processing psychology and cognitive science that focus on the individual mind (Hutchins 1995: 356-359). The

problem, however, is that social activity cannot be reduced to series of cognitive processes inside people's heads (Suchman 1987; Crabtree 2003; Bannon 1991; Button et al. 1995; Becker n.d.). This criticism is not only of social scientific origin, but has also been mentioned in cognitive scientific writings. For example, Hutchins (1995) argues strongly against the *reductionist* approach that seeks first to formally specify human cognition independent of issues such as culture, context and history, and integrate them into the model later (Hutchins 1995: 354). Hutchins maintains that this results in *marginalization of culture*, seeing culture as *a collection of passive items that are operated on by cognitive processes* (Hutchins 1995: 353-359).

The concept of *distributed cognition* (Hutchins 1995) has been introduced to deal with the complexity of collaborative action (Crabtree 2003: 19). As noted by Crabtree, it would in fact be possible to represent social phenomena in terms of information processes distributed across individuals. However, Crabtree argues that this means missing the actual work by which people produce and maintain such processes and how people purposefully use such constructs for example, to retrospectively assemble the rationale of their previous action. (Crabtree 2003: 18-22)

The issue is not only about the validity of the HCI approach, but its usefulness in informing design work. Crabtree, based on Bannon (1991) and studies by Grint and Woolgar (1997), Sharrock and Anderson (1994) and Schön (1988), claims that *cognitive biased HCI* has failed to have an impact on how designers actually come to conceptualize the user. A typical real-life situation is that designers construct *commonsense categories of social types*, coupled with *course of action* patterns or trajectories that define the social type.[6] Designers typify generic behaviors and the generic needs of particular classes of users. This *commonsense method of typification*, as argued by Crabtree, treats the user not as a *cognitive object,* but *an essentially social object* (Crabtree 2003: 28). These objects provide for naturally organized dialogue and co-operative analysis of the design space rather than not equipping design teams with a solid theoretical basis. (Crabtree 2003: 22-33)

A glance at common design practices such as use of personae (Goodwin 2001; Quesenbery 2003), user profiles and associated behaviors (Schneiderman 1998: 67-71) or visualizations such as comic-style storyboards (Keinonen 2000: 217), reveals that the preference is in providing rich material against which emerging design ideas and technical requirements can be reflected. The aim is not *knowing how people's minds function,* but mapping the richness and diversity of human activities and objects that take part in these activities up to what is considered practical and economical for current purposes.

There are two ways to take the heavy criticism of traditional HCI and usability

approaches. Firstly, the criticism can be viewed as *a straw man argument,* treating its opponent as a distinct, normative and individual-biased approach (which is not altogether true), while also pointing out it cannot account for many important things that relate to people and products (which was perhaps not on the agenda in the first place).

On the other hand, the criticism that *some odd version of HCI dominates the discussion* may be valid as it comes from more than one source; not only from the ethnomethodologist camp, but also from psychologists, cognitive scientists and designers.

Personally, I find it difficult to decide which view is more correct. It may be that while the advanced HCI community is well-informed about various movements in the field, there is a large group of people who have completely accepted some narrow, old-fashioned view of human factors without understanding its practical limitations. I have met many developers who think that user research is about finding the objective and context-free rules (e.g., "mental models") according to which humans behave. Worse, there even are people who think such rules are already written down somewhere — and want me to list them.

It has often been said that the traditional HCI approach has little to offer to social technologies. It is thus only natural that social scientific approaches have attracted some attention. However, social sciences and sociology provide no straightforward answer either. Within the social sciences, there are equally *reductionist* and *romantic* tendencies that focus on "objectivist" organizational structures or "subjectivist", individual meanings (Silverman 1998b; Atkinson and Silverman 1997). To understand social action, it is clear we should draw from the social sciences – but what sort of social science?

2.5 Social action – *seen but unnoticed*

So what is so difficult about social action? The point is that without a proper theoretical and methodological background it is a slippery topic. One starts studying it but drifts somewhere else or completely fails to understand the phenomena in hand. The following example, related to text messaging (SMS), illustrates this.

Statistics Finland has regularly followed the use and penetration of new technology in Finnish households. Nurmela et al.'s (2000) survey of text messaging summarizes the contents of text messages in a graph (Figure 2).

In the survey, respondents were given a list of possible contents for text messages, from which list they were asked what kinds of message they had sent during the previous week (Nurmela et al. 2000).

The purpose of the study (or part of it) was naturally to discover what types

of text message people send. Based on the diagram below, I claim that the study did not come even halfway towards its objective. Consequently, it also misses the opportunity to say something more general about text messaging; for example, why they are so popular – if this ever was an issue for the researchers. From the perspective of social action, a closer look reveals the *seen but unnoticed* feature (Garfinkel 1967; Sacks et al. 1974) of the categories in Figure 2.

- In face-to-face situations **greetings** are answered with a greeting. If you do not return a greeting to a person you know, in a situation that the person can see that you have seen her greeting; this may cause her to draw conclusions about your motives or state of mind. For example, she may think you are angry at her for some reason. Although reciprocity is most sanctioned in face-to-face situations, the same patterns of greeting also exist in other media, from postcards to email and text messages.
- **Questions** oblige the recipient most efficiently. Just any kind of action following a direct question will not do. First, since questions restrict the content of subsequent turns, it is preferable for the next speaker to take this into account. Second, questions may be consequential to the organization of turn-taking; the current speaker may select the next speaker from several participants by directing the question to that person only.
- As shown by Bergmann (1993), **gossiping** is the most delicate form of human interaction. One rarely starts conversations by revealing aspects of someone's private life, for example. The ground needs to be prepared before gossip can really get going. This may require several turns of communication. Typically, gossips start with an introduction ("have you heard what happened to X?"). After the information exchange, participants often co-operatively evaluate the gossip ("well isn't that terrible!").
- It takes two participants and usually several messages before messaging can be called **intimate**. One-way messages with **intimate** content are not truly intimate. They are either harassment, stalking or merely embarrassing.
- **Reminders** are often followed by a receipt or gesture of appreciation ("ok, thanks!").
- **Requests to get in touch** by definition require that we either make contact or at least give an acceptable reason for not doing so.
- Messages containing **information** are similar to reminders; it is preferable that we appreciate other people's consideration.

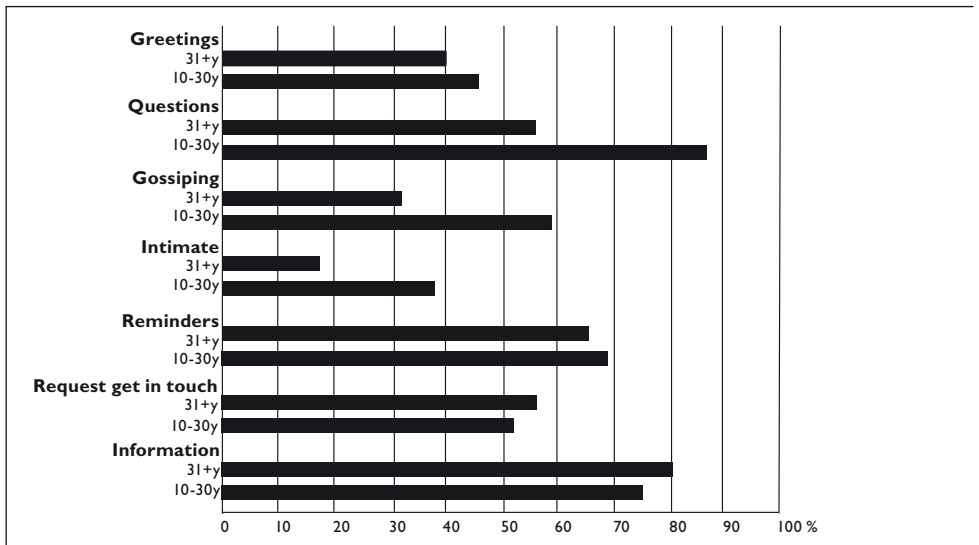

Figure 2: Content of text messages in Finland, 1999 (Nurmela et al. 2000: 14)

Common to all the items listed is that they enable, suggest or even insist that the recipients should reply to the message, or that there have been preceding actions that these messages are responses to. In addition, more than two messages are needed for some items. While this study aims at extensive description of text messaging, the result is not only qualitatively shallow but also quantitatively inaccurate insofar as it fails to list content that is requisite for the categories mentioned.

The interactionist perspective on the same data suggests that text messaging is popular because individual messages have components that invite responses. *Penetration of devices* or *acceptance* in general does not force anyone to send messages. The social pressure that builds is not of a vague and general kind, but concrete and immediate, as it is faced one message at a time. If 87% of 10-30 year old Finns send *questions* via SMS, should someone *answer*?

Particularities of interaction should not be considered as uninteresting and unimportant, since they are what social life is made of. However, precisely because they are such elementary parts of everyday conduct, they are invisible to us unless we know how to look for them.

In the history of technology the mobile phone is worth a chapter or two. Jon Agar (2003) argues that mobile phones provide *constant touch* and therefore fit the *entrepreneurial culture* of big and busy cities. The technology can be also seen as *a shift towards decentralized networks,* providing for *"people power"* that can *bring relief to the victims of natural disasters, fight corruption* and *bring down autocrat regimes* among other things (Agar 2003: 105-112). Even those who think that ordinary everyday events are an uninteresting topic of study should recognize that larger societal phenomena are also grounded in mundane behavior and the social interactions of consumers.

3. THE RESEARCH APPROACH

3. THE RESEARCH APPROACH

Significantly, it has not been asked within design literature so far whether we need to address meanings (psychological, cultural or societal) at all. In the domain of social sciences, Silverman (1998b), among others, proposes an alternative for qualitative research approach, i.e., studying *practices instead of meanings*. This means that it is quite possible and legitimate to study interaction, social action and social practices at their face value without claiming things about individuals, types or users, humans, cultures or societies. This does not contradict the meaning-seeking approach or make it null and void, but provides a complementary view on these issues. For example addressing the practices of meaning-making, or meanings in-action in the case of multimedia provides a more accurate description of user experience related to meaning formation and subjective emotions as part of interpersonal communication (see Articles 2 and 3).

This thread of research has been active in the social sciences from the 1960s, in particular in the areas of ethnomethodology (EM) and conversation analysis (CA). These *interactionist* or *behaviorist* approaches are apart from mainstream sociology, whose core interest is to study phenomena and structures at the societal level (Hutchby and Wooffitt 1998: 24-37). However, in the context of design, neglecting the interaction perspective is less justified, as design work is often about providing something concrete for people to interact with.

The research reported in this book draws from the domains of ethnomethodology and conversation analysis. However, genuine EM and CA researchers (should there be any reading this) might not see themselves in what appears below. Thus, instead of claiming that I follow these two traditions strictly, I have rather described the approach as *EM/CA informed* research, meaning that some corners are cut here and there.

3.1 Ethnomethodology

Ethnomethodology (EM) is the empirical study of methods humans use to make sense of the world and accomplish their everyday activities. Harold Garfinkel, the founding father of the ethnomethodological movement, outlined this approach in his *Studies in Ethnomethodology* (1967).

Ethnomethodology has proven notoriously difficult to explain. A better way to start is with an example of how data is viewed with an ethnomethodological eye from our MMS study.

Monday 18:57
From Lassi to Pekka and Tuomas

Tampereen suurin fallos…
Luulisin.
The biggest phallus in Tampere…
I think.

The first problem is *indexicality* (Garfinkel 1967). Is it possible for an external analyst to understand or interpret this message? Should we decide at the outset what to look for in it? What is the purpose of the message? What are the motives of the sender? Are there personal, peer group related, cultural or societal meanings embedded in the message? Any one message offers many possibilities:

- We can appreciate the **aesthetic quality** of the photo; Näsinneula tower and Särkänniemi amusement park forming a silhouette against the blue and orange of a July sunset.
- Should we put the pretty photo into the **genre** of postcards (Lehtonen et al. 2002) routinely sent by travelers?
- Does the message tell us something about the **pride** Finns have in the highest observation tower in the Nordic countries?
- Does the message re-establish Näsinneula's position as the **iconic symbol** of Tampere?
- Is the sender **bragging** that he got to travel to Tampere? Perhaps the recipients have never visited Tampere.
- Given that the sender is from Helsinki, should we treat the salacious hints as a **comment** on Tampere or its residents?
- Are the recipients from Tampere?
- If so, is the message to be treated as an **insult** or **tease** to either of the participants?

Looking at an individual message, there is no end to the list of possible questions and candidate answers, but little means of testing most of them. The more the external analyst looks at the message, the more bewildered she/he is bound to become – and for a good reason. In the area of semiotics, Berger and Mohr illustrate how one can play the game of inventing meanings with photographs we know nothing about (Berger and Mohr 1995: 85-88).[7]

However, the problem faced on by the participants is fundamentally different to that of the external analyst. The participants are creating messages here-and-now and making sense of the messages they receive here-and-now. Compared to the external analyst, they have at their disposal a substantially smaller set of resources to draw from. Most importantly, for the sender and the recipients, making sense of the photos is not a task separate from the *practical action* they are engaged in, but an *integral part of that activity*. This is where ethnomethodology kicks in. EM takes under scrutiny the *activity as methodical for making the same activity understandable,* rational, orderly, logical, etc. within that setting.

This means that the researcher uses the participants' resources as a means of explicating them. In the case of the message above, the first thing to look at is how the participants themselves interpreted the message from Lassi. The dialogue that followed gives us first-hand information about this.

Monday 19:05
From Pekka to Lassi

Tampereen paras pub. Ookko tampesterissa?
The best pub in Tampere. Are you in Tampester?

Monday 19:50
From Lassi to Pekka

Valitettavasti en. Toijala meni just ja määränpäänä Helsinki.
Unfortunately not. Just passed Toijala on my way to Helsinki

Observing ordinary people engaged in informal, haphazard chit-chat may be frustrating if one wants to discover important societal things with great impact upon mankind. Compared to weighty scientific agendas, the actual doings of people may seem insignificant noise, merely distorted views of hidden things that matter (Alasuutari 1995: 47-62). In contrast to mainstream (social) scientific thinking, the ethnomethodological position is rather that these issues *have to be shown to be relevant to people who are doing the action*. The small, ordinary, prosaic and highly routinized interactions are thus the puzzle to be solved. This is not to say that the larger societal or other structures are not important, but simply to point out that social orderliness of all kinds needs to be constructed from day-to-day in mundane interactions. As Sacks puts it, whenever culture is tapped there is *order at all points* (Sacks 1984: 22).

From this perspective, each multimedia message can be treated as a critical interactional problem for the participants, regardless of how insignificant, routine or trivial they first seem. Commonplace and routine images or messages, just like those that are of great importance, are treated equally as local *achievements*, requiring some effort, some input, before they can be appreciated, ignored, etc., for reasons advocated by the participants. It is the ways of problem-solving of the participants the ethnomethodologist is interested in:

- Looking at the sequence above, it is apparent that the photos were not treated as artistic objects or significant symbols legitimating their own existence. On the contrary, we can argue that sending clichéd or utterly ordinary photos is problematic as it may present the sender as a dull person or as thinking he is so special that others should be interested in the insignificant details of his life. Any message sent or story told potentially wastes the time of the recipient. Sacks calls this the *problem of tellability* (Sacks 1995: 226) that need to be accounted for by the storyteller.
- Accordingly, we can see how Lassi makes the message slightly jocular, which then undermines the possibility that others see him as having a real interest in the items he displays. For this purpose, the joke need not be good either. The message consequently becomes very open-ended. It projects no particular type of action, making it easy for Tuomas to ignore it (as he does), yet providing material for Pekka to grasp and continue the dialogue. Pekka acknowledges the earlier message by echoing the superlative pairing of the first message (*the biggest phallus in Tampere –the best pub in Tampere*). He then asks whether Lassi is in Tampester,[8] acknowledging and aligning himself with the humorous tone of the first message. The question, together

with the photo of a pub entrance, lets Pekka know that he is in Tampere. Furthermore, the reply is also treated as an invitation to the pub, as Lassi expresses regret and provides further details of his whereabouts; he is on a train bound for Helsinki.

- The photos play a key role in the chain of messages. Without the photo, the first message would not have been possible at all. The obvious limitations on how this type of photo can be framed and exposed, from Pekka's point of view make the photo an opportunity for joint activities. Although Pekka could have asked his question without the photo, adding it provides a seamless transition or pairing between the two messages. Similarly, the third message from Lassi then not only replies to the invitation, but does so by adding visual information not captured in his first photo, turning the camera from the horizon down towards the railroad tracks that indicate that he is on a train.
- Meaning-making is inherently local. All items (texts & photos) put forward by the participants stand in *reflexive* relation to each other. These descriptions constitute each other and the situation they describe as soon as they are submitted. (Garfinkel 1967: 1) Consequently, seeing the enclosed texts and images, or the events they capture, in ways not affected by these descriptions is no longer possible for the participants.[9]

In the context of design and technology development, nearly all studies related to human communication are based on interviews, self-reports or other second-hand material, even in cases where direct data about interactions is accessible to the researchers. In addition, this material is often backed up by theories or concepts that are external to the activity itself. It is as if we do not have that all, we ran out of data or that we do not have enough material to be convincing. The example above shows that messages alone provide enough material for us to look at and study. Considering it from an appropriate angle makes the raw data no longer so frightening.

External theories and retrospective talk are not available to Lassi and Pekka as they are sending messages to each other. They only see their own messages, but they make something out of them without difficulty. Ethnomethodology is about dissecting these methods of local sense-making.

The domain of ethnomethodological inquiry is not predetermined since it potentially covers all types of social conduct and sense-making, including those of social scientific reasoning. This makes EM a fundamentally *non-scientific programme*. At the heart of the programme there is a set of *policies* and other key

concepts laid out by Garfinkel and elaborated since by others. Unfortunately, the style of the founding book by Garfinkel is rather cryptic but some key policies stand out and have been elaborated since by others:

- EM uses **participants' observable orientations** to study the **achievement of the social world**. EM accepts no rules or standards external to the actual setting in which they are recognized and used by the participants.
- The emphasis is on **studying human action**. It is about practical actions by members that project for example sense, facticity, objectivity, cause, explanation or communality within a social setting.
- Any social setting is viewed as **self-organizing. Everyday activities are treated as methods for making these activities rational for all practical purposes in the setting**. In principle, this means that we need no external models of frameworks for analyzing a social setting, insofar as these are not available to or made relevant by the participants.
- The aim is to **problematize the routine grounds of everyday activities**. They are treated as organizational phenomena, in which orderliness, logic, rules, etc. are the contingent achievements of the participants.
- This approach opens up an **infinitely large domain to examination** and inquiry. It is about practical actions by which people construct a stable social world and any such act is a legitimate topic of study regardless of how vast or trivial its scope is.
(Garfinkel 1967; Heritage 1984; Coulon 1995)

Written policies and principles do not take us far. Empirical examples show best what the approach is about, conversation analysis being perhaps a better point to begin from.

3.2 Conversation analysis

Conversation analysis, an offspring of ethnomethodology, is based on the work of Harvey Sacks, who was a student of Harold Garfinkel. In contrast to the non-scientific programme of EM, CA is clearly a scientific and methodologically structured approach in the sense that it is most unforgiving as to what is required of data and inferences made about it.

Most methodological imperatives outlined within CA mirror the ethnomethodological assumptions (see Silverman 1998a: 54, 60-73). In addition, CA adds a few of its own.

- **Observational data.** CA is based entirely on naturally occurring, taped and transcribed conversation, including records of nonverbal interactions when relevant. In contrast to approaches relying on theory or logic about speech (e.g., semiotics or speech act studies), CA accepts no invented examples, no matter how imaginable and possible they might be.[10]
- **Recordings and transcriptions.** Summaries of events and early formation of theory or analysis are avoided in favor of detailed transcriptions of the interactions. Inferences are based on data that is presented openly to the reader so that she/he can reproduce the analysis.
- **The prototypical nature of ordinary conversation.** CA uses the structures located in ordinary conversation as a baseline against which other types of situation can be viewed (Raevaara et al 2001).
- **Situated view of interaction.** CA recognizes that since each human action opens up several possibilities for the participants to act, participants cannot anticipate where they will be in few turns from the present. This means that the participants cannot strictly follow a long-term plan (should they have any), but are forced to act here-and-now (Suchman 1987; see also Becker n.d.). CA focuses on this sequential unfolding of events.

The *basic research* component of CA is about structures (i.e., organization) of social action, using ordinary conversation as data for studying elementary forms of social action. The most important forms of organization are:

- **Turn-taking organization** (Sacks et al. 1974). Enables the participants to distribute turns of talk and maintain a fluent and organized conversation so that only one person speaks at a time.
- **Sequence organization** (Schegloff 1968; Sacks 1995: 3-11). Utterances in conversation are sequentially organized. This means that they are produced to fill in a 'slot' provided by the previous turn. Common examples of sequences include first and foremost **adjacency pairs** (Schegloff 1968; Schegloff and Sacks 1973; Sacks 1995: 3-11; Sacks et al. 1974). There is a normative relationship between two utterances. For example, following a question a missing appropriate type of response (typically an answer) is noticeable. If someone does not say what time is it when someone asks, the questioner typically asks again or is offended by the recipient's rude behavior. More complex forms of sequential organization include teases (Drew 1987), accusations, and turning away from troubles talk in a stepwise manner (Jefferson 1984)
- **Preference organization** (Pomeranz 1984; Heritage 1984: 265-280). Although sequences may take alternative courses, sometimes some types of response are preferred over others. Non-preferred responses are visible in how such responses are delayed or how they are prepared for by, for example, providing explanations and accounts. Accepting an invitation is preferred, while rejecting it is non-preferred. This is available for recipients in issues like hesitations, delays, and excuses.
- **Repair organization** (Schegloff, et al. 1977; Schegloff 1979; Schegloff 1992). Provides ways for correcting possible problems in conversation; for example, when the participants have problems hearing or understanding each other.
(Compiled from Raevaara et al. 2001: 15-16; Tainio 1997; Ten Have 1999: 110-123; Atkinson and Heritage 1984.)

For analytic purposes, the notion of turn-taking organization is the most essential. The basic observation is that parties in ordinary conversation manage the distribution of talk relatively easily. There is *no gap, no overlap,* meaning that the next speaker typically starts right where the previous ended and that the participants usually do not talk on top of each other. In most cases, negotiation on who talks next remains implicit. Participants may also use particular techniques to distribute the next turn to particular persons and also have techniques for keeping the floor across *transition relevant places* (Sacks et al. 1974).

Turn-taking and sequencing are also essential features of social conduct beyond conversation. Take for example queuing, games, traffic or human-computer interaction. In some settings there are formal requirements as to who gets to do what, when, and in what order these actions should take place. Sometimes unwanted actions are hampered, prevented or sanctioned. Most often however, social events are self-organizing in the sense that management items related to interaction are integrated into the same activity.

CA treats the turn-taking system for ordinary conversation as a baseline for studying *any* interaction. This is because of its symmetric nature; in ordinary conversation the participants have equal rights and means to participate and influence how and in what direction the activity flows. Deviations from this baseline can then be treated as an indication of some contextual or institutional factors such as roles, goals or other resources which are relevant to the interactions and inference-making of the participants (Silverman 1998a: 165-171; Raevaara et al 2001: 14-26).

3.3 EM/CA applications: CSCW and beyond

Lucy Suchman's book "Plans and Situated Actions" (1987) is perhaps the best-known opening for EM/CA informed research in the domains of artificial intelligence (AI), HCI and CSCW. Suchman's notion of *situated action* challenged the (then) dominant assumptions about human-computer interaction, especially the cognitive scientific "planning model", that posits that plans, i.e., paths from some initial state to goals are prerequisites to human action (1987: 28-29; see also 3.2 above).

A large body of research has accumulated since, not only on human-computer interaction (e.g., Raudaskoski 1999), but especially on complex socio-technological systems. These include call centers, help and service desks, control rooms of various kind, office work, planning work, usage of computer aided design (CAD) systems, etc. (Luff et al. 1990; Button 1993; Thomas 1995; Heath and Luff 2000; Luff et al. 2000; Crabtree 2003). While most of these focus on work processes and organizational settings, the studies in this book also address ordinary everyday activities, for example, multimedia in consumer use and sensor technology assisted social chit-chat. Geared towards images and consumers, earlier research employing this approach include Frohlich et al. (2002) on photo storing and sharing practices; Frohlich (2004) on audio and photos; vom Lehn et al. (2001), Hindmarsh et al. (2002) on conduct and interaction with art works in museums and galleries; Katz (1999) on the interaction of families in front of funny mirrors.

Ethnomethodology and conversation analysis offer *not* a theory of interaction, but a *sensitizing framework* (Button and Sharrock 1995) that is *context-free yet capable of extraordinary context-sensitivity* (Sacks et al. 1974: 699). Crabtree, Benford and Rodden speak of *ethnomethodologically-informed ethnography* that provides sensitizing concepts, *analytic coat hangers* for unpacking social activities (Crabtree et al. 2005).

In contrast to other interaction frameworks, for example, in the area of user-centered design (see section 2.3 above; Battarbee 2004), the framework of EM/CA informed research is methodologically explicit, transparent, self-correcting and rigorously tested and put into practice across diverse settings in social sciences, language and linguistic studies, studies of institutional interaction, workplace studies and CSCW.

4. SUMMARY OF FINDINGS ACROSS THE APPLI-CATION DOMAINS

4. SUMMERY OF FINDINGS ACROSS THE APPLICATION DOMAINS

4.1 Understanding design work

4.1.1 Background and objectives

The activity of *industrial design* is a hard nut to crack. Design work is creative, innovative – artistic even – and often goes hand in hand with cutting-edge technological developments. Like any future-oriented activity, the process itself and especially the quality and commercial success of the outcome are highly unpredictable. At best, organizations can create favorable conditions and construct processes for design activities, but the creative process – as we often want to call it – has largely remained a black box.

Article 1 contributes to our understanding of design work by looking at what designers do as part of a development team. This means studying design as a particular type of problem-solving involving an interdisciplinary team of experts. In addition to the academic discussion on industrial design, the study also has local implications for the parties involved. This approach is in line with the general philosophy of organization development; using the best ethnographic practices to describe and make work visible to the participants, who are then themselves better equipped to adjust their work processes (French & Bell 1973).

4.1.2 Key findings

The article describes the general layout or structure of the design meetings. At the outset of the project, the meetings had no explicitly agreed agenda, so that the structure described was more the outcome of a natural and self-organized flow of activity.

The article also makes detailed observations about how designs are offered for evaluation and how the subsequent discussion unfolds around the candidate design(s) and other material available to the participants. This results in product requirements arising from the candidate design and its relation to the current version of the product. Aspects of the new design either reveal opportunities or clash with known or latent requirements. In either case, the design team needs to come up with a design decision or postpone it until later. Postponing decisions should not be seen as avoiding them, since it often makes sense as solutions to these challenges may later emerge from discussion related to some other item to be solved. For example, the new *frame design* discussed in the article resolved several design challenges at once.

The study aims not only at describing what designers do, but points out the relation between mundane interactions and strategic thinking. Successful products and innovations are not merely products of insightful resource allocation or well-tested processes. This study focuses on particular industrial design meetings inside a large company. However, it can be viewed as a typical example of dissemination of industrial design practices through the business units of Metso Corporation. Pilot projects play a key role; the new (*industrial design*) approach is sold, first with aid of references from the other business units and, second, by giving special attention to pilot projects that follow the initial contact (Mutanen 2004).

In the case of Metso, the lack of formal procedures for the entry of the new development approach is remarkable. Basically, the design organization simply assigns a competent industrial designer who then sits down with the Design Manager and engineering team to discuss what can be done. What the core of the work consists of is also remarkable. The industrial designers at Metso actively aim to improve the quality of mechanical engineering, i.e., work of the mechanical engineers within the organization. This is done by developing designs that minimize the number of machine parts, materials, the number of tools or steps needed during production, on-site installation or maintenance. This means not only massive savings in manufacturing costs, but as a collateral benefit one gets a sleek-looking piece of apparatus. This is Scandinavian design tradition at best. *Form follows function* in production-friendly machines that are economical to produce, communicate what they do, look good, are distinguishable from competitors' products, are easy to maintain and clean, etc.

The Metso approach is rather the reverse of the popular view of design as an activity that focuses on creation of market value through advanced looks and features. The Metso approach is about this as well, but recognizes that sales work need to be done first within the organization, and the hearts of engineering teams are best won by first helping them to improve their work. It would be hard to refuse help from someone who says that in a previous project they *cut 250 tons of steel from a 750 ton product*[11].

Today's information-intensive work, for example, product design, is highly

networked. Understanding how people in such networks go about their work is a prerequisite for offering them (technological or other) support. Describing the particularities of their everyday conduct to the participants helps them to reflect on and adjust their problem-solving practices (French and Bell 1973). The networked and multidisciplinary nature of work arises from the increasing complexity of modern products and services, which requires specialization of organizations and professions. This also has implications for the industrial design practice. As engineering disciplines specialize more in the technological details and processes, there are less *jack-of-all-trades engineers,* who would look at the product as a whole. This provides an opportunity for industrial design, at least in the process and machine industry. Industrial designers do not know much about anything in particular, but they know a little – or enough – about many things. Under favorable conditions, industrial designers are also good at putting the pieces together, as shown by the history of Metso Corporation and the case studied in this book (see also Hasu et al. 2004).

Finally, as a personal note I should add that the Metso Minerals study was an enlightening encounter with the peculiar discipline I am part of. A peek into the black box of design activity revealed that this type of fieldwork could also be conducted with other creative professions that have a similar aura upon them. For example, one could study *art as work;* as practical things done and the coordination required from design and production of artworks to their disclosure to the public and art-buying clients.

4.2 Mobile multimedia in consumer use

4.2.1 Background and objectives

The Mobile Image study launched in 1999 was the first large-scale field study focusing on mobile multimedia *messages* (Koskinen at al. 2002/2001). Mobile multimedia had been trialed before this, but from a substantially different position. We have taken *messages* as *topics* of study instead of messaging as a general *resource* for study (see Zimmerman and Pollner 1973). The latter approach, followed in Maypole (Mäkelä et al. 2000), for instance, seeks to sort types of uses and locate cultural or personal meanings in messaging (Article 3). In contrast, the messages themselves, how people construct them, and how messages interact with other messages has been our interest from the beginning.

The idea for the project came from Dr. Hannu Nieminen from Nokia. At that time it was anticipated that mobile terminals would be capable of sending and receiving rich multimedia messages in the near future. The second version of the Nokia Communicator (9110), together with IR-capable (Casio) digital cameras, created an opportunity for a field trial with ordinary consumers.

The objectives of the trials were relatively open at the outset, since we merely wanted to see what would happen if groups of friends got their hands on the technology. It soon became clear, during the pilot trial that multimedia messages are extremely interactive. People finesse ways of commenting on and replying to messages they receive. They also have ways of building expectations or tying the hands of the other parties as to what sort of next messages are expected of them in the immediate future. This observation was informed by the conversation analytical notion of *adjacency pairs* (Sacks et al. 1974), for example, pairing like questions-answers or greetings-greetings.

It was soon obvious that categorization of messages would not work, as an individual message can routinely do several things at the same time. The basic notion of chaining messages meant that individual messages cannot be the unit of analysis. We would have to look at messaging as an interactive phenomenon.

4.2.2 Key findings

To understand multimedia messaging, one can and should study the messages people send. This methodological recommendation is not as obvious as first seems. Many other studies, before and after ours, have used messages as a resource for illustrating issues that are discovered in interviews or are drawn from some theory (Articles 2 and 3).

The articles related to mobile multimedia in this book have studies of messages taken at their face value, focusing not so much on what people send, but on how the messages are formulated and what sort of interactional consequences thus arise.

4.2.2.1 Multimedia as an interactional problem

It has been suggested (e.g., Okabe and Ito 2003) that along with the ever-present imaging phones, uninteresting everyday items will become tellable and reportable. However, as the technology proceeds, our everyday life is likely to remain approximately the same or will change relatively slowly. This means that the number of exciting things to talk about is likely to be the same as today. Thus, some things need to be changed before our mundane, currently uninteresting items can be selected as topics in multimedia communication.

Harvey Sacks has made a few remarks about storytelling in ordinary conversation. Sacks sees people as monitoring scenes for their storyable possibility.

They may also do *kiss-and-tell,* i.e., do something in order to have something to talk about it later.[12] However, every occasion of storytelling involves the *problem of tellability* (Sacks 1995: 222-228). It is typically in the interest of the teller to engage the other participant in listening. Sacks recognized that there are two key components of story prefaces:

> - First, there are **interest arousers**, ways of saying that something interesting is about to come. This may be saying that something terrible or wonderful has happened.
> - Second, there are ways of saying that **what is said next may oblige the other participant** in some way. For example, the storyteller informs the listener that a reply, assessment or appreciation of some kind is expected.
> (Sacks 1995: 222-228)

Sacks' notion of the first speaker's means of arousing and obliging the recipient is applicable to mobile multimedia messaging as well as everyday conversation –-. The difference from ordinary conversation is that both the introduction or opening and *the point* are typically intermingled in the same message. In messaging, there is no natural slot for the recipient to indicate whether she/he wants to receive the next message. It is then entirely up to the sender to motivate the message as she/he sends it.

For an external analyst who seeks to sort out *content*, photos of everyday activities can be amazingly banal. However, the photos are seldom treated as such by the participants. It requires some effort to keep the other party interested in photos of *dirty dishes, shopping at a corner store* (Article 2) or *railroad tracks shot from a moving train* (above). At the least, we do not want to unnecessarily puzzle the recipients. Text has an important role here (Koskinen et al. 2002). As photos themselves are often equivocal, the sender can and often does tell the recipients how to read the message. These instructions then also legitimate the sending of the photo. In a single message, people can also use several methods of explaining, accounting or providing instructions. In addition to being self-contained, messages are context-sensitive, which means that they often draw on previous ones implicitly or explicitly. Thus, the sender has at least these options for any individual message being composed:

- **The interest arouser method** (see Sacks above): As part of the message, the sender can point out that there is something interesting, worth seeing or worth telling about.
- **Retrospective methods**: The sender can compose the message as a reply or response to an earlier message or messages. Messages can also be constructed to appear as part of a series or theme developed earlier (for example photos of boyfriends or girlfriends). The sender need not rely simply on messages from others, but may add or comment on her/his own messages (for example *monologues, stories, self-corrections* and *add-ons*).
- **Prospective methods** (see Sacks above): As part of the message being composed, the sender can project particular types of next actions, i.e., oblige or engage other recipients in the conversation. Those who reply or respond to them then make these messages relevant. For example, questions invite answers and greetings invite greetings (see 2.5 above). There are also more complex dialogues, such as *teases* and *puzzles*. People have many ways of making missing replies noticeable. Missing replies may also prompt sanctions.

However, in talking about everyday events and objects, one cannot simply employ all possible means to engage the recipients in listening. Interestingly, there are also:

- **Interest killers**: ways of pointing out that there is nothing particularly interesting in the message that is nevertheless sent.

These methods come in various forms including *accounts* and *apologies*, but also references to ordinary cultural forms or interactional patterns of communication. Take for example the opening of the message below from Eija (Koskinen and Kurvinen 2002).

Example 1: Hanko Tourist Pictures
Hanko Tourist Pictures
Date: Mon, 19 Jun 2000 23:57 +0200
From: Eija

And here's one more shot from Hanko -- one of those typical tourist pictures (- - -)

Before going to the subject matter of the message, Eija indicates that the message should be viewed as part of an earlier set of messages from Hanko, and as a set of typical tourist photos. Eija offers seriality as the first account; because

there already are messages like this, one more can be added to the set. Second, she *announces the ordinariness*[13] of the photos, also providing a rationale for having taken and sent these photos to others. She implies that this is to be viewed as "commonplace touristy activity" and sharing photos of this kind is "conventional to an extent that they may actually be boring" (Koskinen and Kurvinen 2002: 128). "Nothing much" or "ordinary course of events" can also be used to provide a backdrop against which to highlight tellable events (Sacks 1995: 232). After her opening, Eija goes at length into the conversation she had with the other travellers in Hanko.

When constructing messages or explaining photos they send, people draw from ordinary cultural forms, for example, postcards, photo albums (Koskinen and Kurvinen 2002) or movies (Article 6; Koskinen et al 2002). From the interactionist perspective, the interest is not in finding out what the cultural forms are, how many there are, or where they are located, but to understand the activities through which people manage to explain their multimedia messages in terms of some imprecise set of ordinary formats.

For example, if people observably send messages that they themselves downgrade and label as unimportant, this is likely to have some procedural consequences. As all messages potentially oblige the participants, the sender needs to balance between engaging but not excessively bothering her/his audience. Messages can be structured into self-contained coherent units that require no further action from the recipients, but the recipients have no way of knowing this before skimming through them. The more and longer messages they receive, the more laborious this all becomes. It is therefore only considerate to assist the recipients by announcing the point of the message, its potential consequences or lack of clearly enough at the start of the message.[14]

4.2.2.2 The importance of interaction

As each article discusses only a small set of examples, readers may question the importance of interaction. In the MMS study, we took a small sample of 100 messages and found that 43 contained an explicit textual formulation that seemed to link them to previous messages. Secondly, to test our first impression, we checked the messages before and after, to see whether the participants themselves treated these messages as parts of sequences. We found that in 32 cases of the 43 our first impression was generally correct; meaning that every third message explicitly comments on an earlier one or invites a particular kind of response. This alone is a strong indication of the reciprocal nature of the activity.[15] Interactional sequences of a different kind, which have long preceded the technology, are the basis for orderly acts that people use in everyday ordinary life to make sense, reinterpret and direct their activities. They also explain a good deal of variation in use over time (Koskinen 2003; Article 6).

Other researchers are even more convinced about the importance of interaction. For example, Kasesniemi and Rautiainen (2002: 186) conclude that leaving an SMS message unanswered for 30 minutes is almost without exception interpreted as rudeness.[16] Similar findings have been reported by Laursen (2005) and Taylor and Harper (2002: 13).

4.2.2.3 Interaction as a topic

Instead of merely noting that messaging is reciprocal activity, we can study how it is reciprocal and what makes it such. As discussed in Article 2, the recipient's orientation or interpretation of the messages is often apparent in her/his reply. The recipients may follow or challenge what was presented earlier. Consequently, the meanings attached to photos we share are not fixed, but an outcome of a chain of contingent selections between alternative ways of seeing individual messages. Reciprocity is not only formal or mechanical; people do not just take turns in sending whatever stuff to each other, but have delicate ways of acknowledging and adding to the earlier contributions. Furthermore, they are accountable for doing so. Just telling your own stories without positioning them in relation to those of the others would soon lead to social sanctions.[17]

We also observed how the meaning or usefulness of unused photos may change as the conversation proceeds. The example of "the man and the paddle" (Article 2), shows how a photo that was taken before became useful in turning the monologue of another participant into a joint theme. Photos are not only taken to share through some foreseen procedure, but older photos may also become later useful as part of the ongoing process (Article 2). Furthermore, when cameras are involved in social events, the activities may turn into a game for the camera for sharing later. Such stories become reportable, tellable and shareable in many ways at both the sending and receiving end. (Article 6; Battarbee 2004)

Article 6 discusses also how cinematic way of telling provides conventional means for constructing messages. *The Lammassaari murder case* (Article 7; Koskinen et al. 2002) shows how people do not just follow genres of conventions, but use them a resource. For example, the sender is able to jump out of the storytelling frame easily into a prologue or advertisement type of frame, and from there directly to the Oscar gala that closes the series. Conventions and routines as *a resource for the participants* are also discussed in Article 3. In that case, a highly routinized (engagement) *announcement-congratulation* pair was challenged by a teasing comment that then led to the clinching counter tease. The article also illustrates the tact and finesse enabled by combinations of photos and texts. With subtle variation of a simple visual theme (hands and rings), the

participants manage to build an argument and counter-argument around love affairs, sexual activity, personalities and the life styles of the parties.

Aside from purely instrumental uses, most messages in our data employ a degree of open-endedness. Although with photos and texts one could describe things explicitly and in great detail, people often choose to be vague. At the touch of a button one can imply many things and offer possibilities for the recipients to grasp. Saying *"you know what I'm saying and what to say next"* can be done easily with images. The recipients are then to fill in the gaps, which not only eases message construction, but provides for delicate recipient designs (Sacks et al. 1974; Sacks and Schegloff 1979; Arminen 2005: 198, 208-215). Recipient designs utilize *"what the other party can be assumed to know"* to build such things as a teaser, puzzle or story with intertextual elements. The treat is not so much in the enclosed information, but in the act of unpacking it and realizing that it was made especially for the recipient(s) to decode (Koskinen et al. 2002: 51-52). The case of MMS teases (Article 3) shows also how open-endedness and recipient design, i.e., letting the other party to fill in the gaps, enables messages that are blunt and offensive but with a humorous tone so that both parties save face.

4.2.2.4 Images and texts

The engagement announcement with photos of rings and hands and the responses which followed would not have been possible without photos. As Kristóf Nyíri puts it, images are *natural carriers of concrete meanings* (Nyiri 2003: 161). Images and photos provide a natural interface. Still photos can be produced and, at will, also consumed quickly. This is in contrast to video or audio, which require a preset amount of playback time at the receiving end. Everyone, from small children to the elderly, knows how to behave in front of a camera. People gather together in front of cameras to be photographed and then later in front of the photos to view the outcome (Koskinen et al. 2002; Frohlich 2004; Battarbee 2004). However this is not about images alone. Our studies, starting from Koskinen et al. (2002/2001), show that the true power of images can be unleashed only with the aid of texts. Focusing on images alone is likely to cause problems at some point. For example, the researchers in the Maypole study built a prototype for sharing of images only in order to study the potential of pictorial communication without the presence of disturbing variables like text. Consequently, one of their key finding was that people wanted to add text to their images and developed means of doing so (Mäkelä et al. 2000).

The importance of text does not mean that people always need to enclose textual descriptions with the images they share. There are other means to provide the same information; aside from their multimedia messages, people send text

messages, speak on the phone, and discuss photos face-to-face. They may also have participated the events in the photos or may have co-constructed these photos together (Koskinen et al 2002; Battarbee 2004). In our data, only rarely was language (spoken or written) not needed to coordinate joint understanding of the photos. Even when photos have been sent without text, it is often clear that some kind of dialogue has preceded them. In another study, Van House and Davis discuss a particular photo of slice of pizza that served for a moment as an intertextual and communicative symbol of the city of New York because of the reputed superior quality of pizzas there (Van House and Davis 2005). It should be obvious that some kind of dialogue is needed to implement this detailed intertextual vocabulary with photos. Before you can have *Big Apples* or *Pizzas* representing cities, language must have been used at some point.

4.3 Ubiquitous and context-aware computing

4.3.1 Background and objectives

The vision of ubiquitous computing builds on the idea of the pervasive presence of heterogeneous and highly connected information technology. In addition, to overcome the inherent complexity of such systems, it is anticipated that they should be either autonomous or semi-autonomous, requiring only minimal user interaction or exploiting implicitly available sensory data from the environment and on the behavior of the user.

In ubiquitous environments of this kind, even the traditional usability and HCI design challenges will become highly complex. Insofar as these systems are used by several people, they will also have a social dimension. Many human activities, including those that involve technology usage, take place in the presence of other people and/or involve interaction or coordination between people. Human behavior and action usually orients to the presence, behavior and actions of the other participants in the setting.[18] From the end-user perspective, the challenge is not so much the presence of the technology, as it can often be ignored, but its participation in activities between people, especially if this participation involves system intelligence.

4.3.2 Key findings

One typical scenario for this type of intelligence is that the mobile telephony system interprets or knows that the user is at a meeting and adjusts the ring tone accordingly, or offers applications suited to the situation (Wagner et al. 2005).

These concepts presuppose (among other things) systems that will be able to tell when distinct types of human activity or events begin and end. In Article 4 we considered three different real life examples of how people invite each other to do something together to better understand how such transitions should be managed in a user-friendly way.

We observed that people often initiate events or "contexts" gradually rather than abruptly. For example, Article 4 mentions a playground worker who coordinated a weekly *sing-and-play* with parents and children. She did not use the public address system to inform everyone about the event or invite the parents and kids face-to-face either. The invitation consisted of her taking a detour around the centre of the park, greeting and casually talking to some of the parents. The walk around the park made her presence visible, which was enough to inform everyone that the play was about to start. Another case consisted of an invitation to lunch as it typically happened amongst workers of a weekly IT-magazine. Again, instead of explicit invitations, a few people gathered close to the coat rack for a moment, which served as an invitation to others to join, for instance, by way of asking "are we going now"? (Article 4.)

The invitations discussed in the paper were offered in a most discreet manner. Although, those who were still busy working at the office were not bothered explicitly, the invitation was made peripherally available to them. Invitations of this kind are also recipient-friendly as they enable the party invited to not participate without having to provide an explanation of why.

Article 5 further elaborates the challenges that relate to machine-made reasoning in social settings. The study focused on a fairly sophisticated mobile system that collected heart-rate (HR) information from eleven teenage football players and displayed an overview of the information to parents and coaches beside the field. Just as in Article 4, our objective was first to study human reasoning and then think of possible ways to turn this understanding into system features or design drivers.

We soon noticed during the trial that the parents did not have enough scientific knowledge of the human body to make sense of the data in terms of efficiency, performance, e.g., party line concepts. Furthermore, the data shown on the mobile terminals was partially corrupted because of problems with the network sensors. Some boys were simply too skinny for the belts to fit properly. In addition, connectivity problems also caused delays.

However, despite of the lack of background understanding, various technical problems and the fact that the UI was not very sophisticated, the parents followed the HR data intensively throughout the 1.5 h session. It appeared that the activity of *making sense of the data together* was motivating enough to overcome all practical obstacles.

The paper further explains what this activity consisted of; for example, how the application helped people to get to know each other better, how *ad hoc* groups were formed around the devices, how opinions of various kinds were formed and comparisons made between the players and between them and the members of the audience. The paper not only provides design implications for the application domain, but also discusses system intelligence vs. human reasoning in general. It suggests that true design potential lies in the interpersonal interactions this type of sensor technology could support. However, to provide a sales argument at the outset, some type of "rational use" may be needed. It is strategically wiser to sell systems "for sports" than "for social chit-chat", although what users would actually use them for is closer to the latter.

In the domain of CSCW, Jack Whalen has pointed out that systems need not be overly complex or intelligent to provide support for complex human tasks and human collaboration. Instead of developing *Expert Systems* that seek to *replicate* or *replace* human work practices and problem-solving strategies, Whalen calls for *Systems for Experts* that support human reasoning and human decision-making (Whalen 1995). The distinction is also useful in the area of consumer products and leisure technology. For the participants in our trial, the point of using the system was in the collaborative and social sense-making and discussion concerning the HR data. Some system making the inferences on behalf of the users will be at risk of removing the key motivating factor. This does not mean that there should be no machine inferences at all, since some type of abstraction is needed to make better use of the raw values, especially if one wants to use it as training aid as well. Rather, it is about finding the kind of balance between machine-made inferences and human reasoning. Special attention must be paid both to the transparency of system-made inferences (Whalen 1995) and the way they are graphically (or otherwise) presented to the user. For example, in our study the users largely ignored the *smiley* (emoticon) that was used to display the current status of the person compared to his personal minimum and maximum HR values. Instead of helping the users to understand what is needed to practice properly, the smiley was merely hiding information from them.

4.4 Logic across cases and domains

The six articles in this book come from six different projects and, roughly speaking, three different application domains. Data collection methods used include ethnographic observation and field notes; collection of documents, photos and other materials people have interacted with; analysis of messages; transcriptions of speech, videotaped activities and videotaped interface navigation; interviews and casual conversations with people.

Despite diversity across cases and materials, all studies have consistently followed one conceptual framework. The focus in each case has been on social action and argumentation has been based on observed and recorded actions between people. The other materials, for example, opinions of the participants, were used to support the analysis of what people do, not the other way around.

The order in which the papers appear reflects the history of the EM/CA approach. Its best-known practical applications are in the domain of workplace studies and CSCW, both of which are demanding because they often involve many participants, complex distribution of work tasks and institutional and technological constraints. Most importantly, should research aim at changing or improving existing practices in these settings, as is often expected — failures may have serious consequences on efficiency, economy or safety. It is therefore crucial first to understand what the activity consists of, and design for it only then. For example, if one investigates air traffic control rooms pre-equipped with a rigid theory on cognition, social aspects, technology or whatever, one is unlikely to find much of use to those who work there.

Article 1 follows this tradition and serves here as an introduction to the approach. From workplace studies, the conceptual leap to consumers and leisure time activities is significant, yet requires little (if any) change in actual research tasks. This time we just speak of consumers using the technology not for work-related things but for ordinary everyday activities.

The Mobile Image book (Koskinen et al. 2001/2002) has already illustrated the usefulness of the EM/CA approach. The book itself was not CA centered, but owes certain concepts such as seeing photographs and messages in their sequential context to CA. The two mobile multimedia studies that followed validated our initial notion: in the MMS study people received the messages immediately, which then further boosted the number of replies and responses (Koskinen 2003b); our low-fidelity paper prototype study (Article 6) showed how intensive and interactive collaborative album creation can be.

The Articles in this book have further elaborated our notion of messaging as a highly interactive phenomenon. In addition, the studies have taken messages and the sequences they form as a topic of detailed analysis. In contrast to the Mobile Image book, which was more sociological, this has also meant a shift of focus towards conversation analysis.

The Mobile Image and the MMS studies were almost exclusively based on analyzed messages. The obvious critique is that we did not look at how people actually constructed these messages. The Wireless Image study partially answers this criticism. Furthermore, Articles 1, 4, 5 and 6 show that the conceptual framework also works well in "*live situations*".[19] In the case of multimedia messaging, we did not focus on messages because of a methodological handicap, but because of research economic reasons.

The studies reported in Articles 4 and 5 are also part of a continuum. The former was conducted during the early stages of the project, without any technological intervention. The latter was also from the early stages of the project, although the mobile prototype was already fully functional. The general idea of *turn-taking* and its relevance to ubiquitous and/or context-aware computing was introduced in Article 4 and then elaborated in Article 5.

5. CONCLUSIONS: TOWARDS A PARADIGM FOR PROTOTYPING SOCIAL ACTION

5. CONCLUSIONS: TOWARDS A PARADIGM FOR PROTOTYPING SOCIAL ACTION

The objective for all studies in this book has been to observe and study naturally organized human action. This is also the core of the conceptual framework provided by ethnomethodology and conversation analysis. An earlier version of the *paradigm*[20] suggested in this thesis was described by Kurvinen, Koskinen and Battarbee in Article 6. This article outlines five general conditions or principles for prototyping social action. However, further clarifications are necessary for understanding and fully applying the perspective that has informed this book.

5.1 Providing a setting for naturally organized action

In prototyping social action, the first objective is to provide a setting for *naturally organized action*. This does not exclude intervention, such as the use of prototypes. Industrial design is largely situated in a hypothetical world (Koskinen 2002) dealing with products and concepts that do not exist yet. The first objective of *prototyping social action* is to provide a setting in which the actions people produce are not directed at the researchers, but at the other participants to make sense and provide a basis for their next action. An appropriate setting makes the participants accountable for the rationality and intelligibility of their actions to the other users. The researcher then observes how they make use of the material provided by the prototype in concert with the other participants.

The beginning of the process is analogous to what often happens at the outset of ethnographic research, for example, at a workplace. After an agreement with the researcher is made, he will participate in the workplace meetings, studying some aspect of them. When the first meeting starts, he places an audio recorder on the table or a video camera in the corner of the room, takes a notebook and mostly sits quietly thereafter. The presence of the researcher and the recording devices may attract some attention at the beginning,[21] but typically they are forgotten quite soon and the participants start to act normally. This is because people have work to do and they cannot pay too much attention to the presence or motives of the researcher (Becker 1970: 42–62).

5.2 Specimen perspective

UCD and usability literature stress the importance of *observation* over other methods used (see Section 2.2 above). How to observe and what to do with the observations have attracted less attention. Following the interactionist or EM/CA informed approach, the articles in this book have adopted what Alasuutari calls *"specimen perspective"* (Alasuutari 1995: 63-69; 34-41; Koskinen et al. 2005; Ten Have 1999). This means focusing on individual events and *meaning structures within* these events (Alasuutari 1995: 68).

In contrast, what Alasuutari calls the *"factist perspective"* (Alasuutari 1995: 47-62) currently prevails in design, e.g., because of the tradition of HCI and usability. In traditional anthropological language, usability researchers work from an *"etic"*[22] perspective, using concepts on people in an attempt to understand what people are doing. The factist perspective treats data, the actual sayings and doings of people, as uninteresting, useful only insofar as it provides a distorted view of the reality 'out there' that is the true interest of the researcher (Alasuutari 1995: 47).

Specimen perspective research dissects features of a specimen that is extracted from a larger, complex entity. The idea is to refrain from claiming things about the external reality beyond the specimen. The contribution of this type of research depends on the richness, novelty and plausibility of the description it provides. Transparency of analysis plays an important role, both data and analytic claims being presented in ways that enable the audience to assess them. It is also important to distinguish between two phases of the process. First, there is feature extraction from the specimen, while mapping these features onto external reality is an altogether different business. Once the specimen is dissected, it is located within the context of previous studies and scientific debates, through which its ultimate value and usefulness can be weighed. (Koskinen et al. 2005: 62-74)

The line of reasoning throughout the articles is that people actively engage each other in interaction (with or without the assistance of technology) and this process calls for detailed analysis. For example, in the case of multimedia, this has meant looking at the details and temporal explication of particular chains of multimedia messages. Articles 2, 3 and 6 argue that social engagement grows from the bottom up and the message per message basis when individual messages cross-reference, comment, question or reply to each other. This does not equate to saying that this is always how things go with multimedia systems or that all messages in our data were like this. It merely indicates how things evolved in these particular cases; they are not to be considered as truth statements, but *partial descriptions* of a complex whole.[23]

The argument here is that a specimen perspective is required for investigating social services, applications and environment. This does not compromise reliability and validity, which should be addressed in terms of the approach, not following the positivistic ideals of the *factist* perspective.[24] Specimen perspective in general and in the context of social prototypes means tact formulation of research questions and specific attention related to the scope of claims made about the data. This perspective not only fits the overall philosophy of user-centered design, but provides information that is useful for long- and short-term developmental purposes.

5.3 Generalizing from case studies

A lot has happened since we started collecting our first set of mobile multimedia data in 1999. From this time perspective, a few notes about generalizability are appropriate. Since 1999, market expectations and focus have shifted a few times. Many of the ideas previously presented under the umbrella of 3G (third-generation mobile phone) or UMTS (Universal Mobile Telecommunications System) are now reformulated as part of B3G (beyond 3G). Handheld terminals are now capable of doing everything promised when we started our studies. There are no obvious commercial success stories yet, but increasingly many services for mobile photo sharing, viewing, printing, etc. Some of them are being developed as location or context sensitive in research projects between academia and industry.[25] Even traditional social scientists have been awakened; mobile telephony is no longer a technological vision, but an existing societal phenomenon, which makes it a legitimate topic of study.

Given the pace of development and all the parallel progress across disciplines, how should credible research angle in the area of mobility and multimedia be maintained? Researchers are at a great risk of replicating present time concerns; expectations, hopes, fears and buzzwords. As often happens in R&D related writings, authors also marginalize their own work by presenting it merely in reference to other technological systems – indicating how this solution was better than some other piece of code written elsewhere[26]. While catchy today, punchlines – if the analysis remains there – are unlikely to survive for long. Neither will there be much left of contemporary application driven writings in a few years.

Despite the progress across domains (societal, market-related, technologies, devices, services, etc), our initial *interactionist* or *behaviourist* perspective (Koskinen et al. 2002/2001) has survived time extremely well. Detailed, EM/CA informed analysis of structures and features of particular activities is not a step away from generalizability. Rather, it is a way to ensure that we go to the essence of the phenomenon; the elementary components and building blocks of technology-mediated interaction instead of, for example, features of particular applications or up-to-date societal themes and concerns. As mundane patterns of interaction are evolving slowly, understanding prototypes, images, texts, audio or sensor data as part of these activities enables generalizability across domains and time.

To generalize, or make use of the studies in this book, one distinction should be kept in mind. First, one should not carelessly generalize about the actual physical prototypes or the technology involved. This is because details of design or some aspect of technical implementation may have a significant influence on user experience with the product.[27] Ultimately, it is *not what you do* in design, *but how you do it*. Second, remarks made about social interaction involving people interacting with each other with aid of some system can be generalized to a great extent.[28]

In other words, studies that seek to foresee the *end result* of social action[29] are on thin ice, while studies that describe the *means* by which people collaboratively come to a conclusion about some event or entity strike a better balance between research questions and the means to answer them.[30]

These two discussions should be kept separate: generalization about technology as against development of (user) research practices or theory within. The latter is important in the long run so that not every project needs to start from the scratch. This work is one step towards combining the best practices of ethnographic fieldwork to design. Crabtree (2003) and Battarbee (2004), among others, have suggested similar ideas and there is evidence that such combinations are needed and that they are useful.

5.4 The economy of the EM/CA approach

The downside is that CA is generally considered as a painstaking way of working. Labour-intensive and time-consuming methods are not considered useful in industrial settings. Based on my personal experience, I tend to disagree with this claim. I argue that *EM/CA informed user research* is an economic and cost-effective way to generate deeper understanding of product usage through interpersonal and human-machine interaction, provide food for thought, system requirements, strategic understanding or whatever is needed in the design process.

The CA approach by no means provides simple solutions to complex problems or is adequate for genuinely simple tasks or any kind of user research task. However, as the complexity of research challenges related to social action increases, I see little alternative if one sincerely wants to understand the phenomenon in question. For such tasks, CA provides practical instructions on what sort of

data to collect, how to collect it, process it, prepare it for analysis, share it with other researchers,[31] bridge between data and analytic claims and to return to data for verification of these claims (Arminen 2005; Ten Have 1999; Hutchby and Wooffitt 1998; Peräkylä 1997).

This does not mean that every piece of recorded interaction needs to be examined in the greatest detail or that every traditional principle that stems from the methodological writings in basic research needs to be followed. For example, Article 4 draws rather loosely on the notion of turn-taking introduced in CA, while analysis of Example 6 in Article 5 goes into the details of turn formulation. The fidelity of the method can be adjusted to match the research questions.

We have had no problems meeting deadlines because of time-consuming data processing. For example, an earlier study done for Razorfish Inc. on usability testing procedure was explicitly conducted as an exercise in discount conversation analysis (Kurvinen and Koskinen 2000). The first feedback presentation was given in a week from receiving the videotaped material and the full 46-page report was provided six weeks later.[32] Similarly, the distance from us getting our hands on the Radiolinja MMS data to a draft report was two months, after which it took another two to deliver the final version.[33] The key is not the method as such, but research planning and adequate resourcing. If one knows what to look for and which questions to tackle, things can be done relative quickly. For example, some routine tasks in data collection and preparation require no specific skills and can be out-sourced.

Furthermore, in this research tradition, there are efficient ways of working with large sets of data, following the basic principles of analytic induction to generate concepts and ideas from data (Arminen 2005: 71-79) or theoretical sampling (Glaser and Strauss 1967; Seale 1999: 92-95), if one wants to focus on particular cases or concepts.

In our experience, data intensive studies communicate well, even for industrial audiences. In that context, the analysis need not be exhaustive and detailed to have impact. It can be used as source of inspiration just like any less rigorous, aesthetic or less analytical material. CA studies also accumulate exceptionally well. This is inbuilt in the approach. The economy and cost-efficiency of this approach is often based on the fact that it is possible to apply learning from previous projects to new problems.

5.5 From *critical* to *constructive* perspective

From the point of view of systems design, EM/CA approaches are generally considered to be more *critical* than *constructive* (Button and Dourish 1996). For example, when one looks at actual uses of complex systems, one is likely to find many incompatibilities between technology and the organization of work (Button and Dourish 1996) and less immediately applicable system requirements (Dourish 2006).

There are several possible responses to this criticism and there have also been attempts to respond better to the practical concerns of designers.

Firstly, CA-type transcripts represent stepwise unfolding of social events. These representations are not far from the flow diagrams already used by interaction designers. For example, in the case of multimedia, designers can seek ways to account for a variety of response types recognized in the data.

Second, ethnomethodological accounts often contain patterns that recur across cases. These patterns can, with aid of appropriate abstraction, inform study design, support less experienced researchers to do fieldwork, help designers making use of ethnographic data, or assist ethnographers and designers interacting in scenario or requirement creation. (Crabtree et al. 2002; Martin and Sommerville 2004) Such examples also allow the users or participants themselves to construct accounts of their activities (Martin and Sommerville 2004). Finding common features between cases also enables the designers to consider previously used solutions to solve current problems.

Third, Button and Dourish also point out that ethnomethodological policies and concepts can be used to address more fundamental technological principles in system design; for example, representations of the system state (Button and Dourish 1996).

Fourth, according to Button and Dourish, the most used and successful way is to use the ethnomethodologist as a *proxy* for the users. Design ideas can be "*bounced off*" the ethnomethodologist, who is able to draw from the details of field observations and therefore both evaluate designs and contribute to generation of designs. (Button and Dourish 1996)

Fifth, Crabtree (2004) suggests that prototype designs can be considered as a kind of *breaching experiment*[34], where *technology becomes a vehicle for social research* (Crabtree 2004). While the typical view is that ethnography is used to inform design activities, we can also envision another kind of social research in which intervention is not a problem, or the last step in the process,[35] but an opportunity to extract information from the social scenes and their underlying principles.

In sum, despite it being critical, this approach can serve many purposes in the design process.

5.6 EM/CA and user-centered design

While the list above is about what ethnomethodology (or ethnography in general) has to offer for design, we should still clarify its place in the design process. The point here is conceptual, aimed at advancing a shift in thinking rather than suggesting something totally new for the most advanced design practice (Article 6).

There is some debate over whether design has much use for objective user research. There are orientations within design that defy or actively avoid explicit analysis or explanation of human behavior. Because room is needed for creativity, *openness* is often preferred to *knowing* (Sengers and Gaver 2006; Section 2 above). For example, earlier HCI-driven scientific agendas can be seen to have obscured and interfered with the actual activity of product creation (Crabtree 2003; see also 2.4 above).

However, understanding the user, or rather her behavior, can certainly live side by side with the *user inspiration approach*. If designers can be inspired by or make use of *scenarios, use cases, task flow diagrams, storyboards* or *stereotypes of social types* like *personae*, surely they can be inspired by vivid descriptions of real people and their actual interactions. Insofar as self-made stories about average or imaginary behavior can be used to think of interactional details and technological support for them, so can real-life descriptions that are already full of such details. Transparency of analysis, the key component of research quality, not only ensures that user-centeredness takes place,[36] but also provides plenty of material to grasp and be inspired about. Even if we want to take the artistic approach instead of *inspiration that draws from inspiration,* we can have *inspiration that draws from reality* since it is already wonderful and full of surprises.

One objective of all of the papers in this book has been to tell a good story. Instead of presenting an extensive list of user research findings, accounting for methodological complications and possible counter-arguments, I/we have used whole articles to present *one* point, and illustrated it vividly with the help of handpicked examples that may not be representative but serve well in building the argument. In contrast to this, the intention in Articles 1 and 5 has been more to capture the essence of the phenomenon; for example, Article 5 seeks to account for both interview talk and key interactions from the 1.5-hour football practice. The point is that following the specimen perspective I can choose between the two approaches based on what is needed in the project. This is not possible with data such as artistic material created by the users.

What purposes does user research serve then? Its value is most often assessed by its ability to provide requirements for products, i.e., helping to *decide what to build* (Crabtree 2003: 3-4). However, one should not mistake this for the only objective of design, designers or user researchers. For example, Keinonen et al. (2004), in their overview of *product concepts* and their creation comment that the activity and its outcomes serve several purposes in organizations:

- To prepare for actual implementation and product design phases
- To provide the groundwork for development of significantly novel solutions within the organization
- To map possible futures and alternative courses of action in order to support strategic decision-making
- To educate and develop the creativity of both the individuals and the organization
- To affect the expectations of the consumers and therefore prepare the ground for a favorable future
  (Keinonen et al. 2004: 35)

The list above reveals that "product concepts", which surely are at the heart of industrial design, are not stand-alone objects but are intermingled with various organizational activities and objectives. For example, their target audience is considerably larger than the R&D department, and their effects, at best, reach beyond the organization to the whole business area all to way to the consumers (Keinonen et al. 2004).

In this light, seeing "design" or "industrial design" solely as the creation of products and services is a restrictively narrow view of the multitude of processes designers are involved in. This is also a narrow view of what "products" or "services" are, what the reasons for their creation are and how far-reaching their consequences may be.

Similarly, seeing user research as requirement generation for "designers who then create products" is a gross oversimplification of the activity. For example, the studies in this book have involved a diverse set of activities and developmental phases:

- ethnographic research without prototype intervention [2; 5] vs. prototypes from low [3] to high [6] fidelity;
- directly observing prototype usage [3; 6] vs. following the participants' doings remotely [1; 4];
- exploratory experiments [1; 3; 6] vs. testing or trialing a commercial service just before launch [4];
- informing particular design tasks [2; 6] vs. aiming at improving the overall work processes of design [5];
- providing material to inform and inspire designers [1-4; 6] vs. studying how various materials inform and inspire designers [5];

- employing the researcher as a part of the development team [2; 6] vs. using him as an external consultant [1; 3; 4; 5]
- providing design drivers or specific application features [1-4; 6] vs. providing implications for components beneath the application layer[37] [6] vs. providing implications for business models[38] [4][39]

One should recognize that oversimplified and narrow definitions of design serve the purposes of a power game around and internal to the design discipline. Instead of positioning the approach in specific developmental phases or abstract terms, I suggest that the work reported here falls somewhere between ethnography and a diverse set of design related activities.

In the final analysis, the key contribution of the approach is not so much about saying what the future product or system should be like. Rather, it is about providing a more accurate description and understanding of the social phenomena related to the product or service idea. Looking back at Figure 1 above, the generic process of user- or human-centered design activities, the studies here fit best in the "understanding" box. While designers often employ naive descriptions of social types and their average behaviors (Crabtree 2003: 27-28), the EM/CA the approach provides a *thick description* (Ryle 1968) of real-life interactions. After that, how to use this information for their benefit is ultimately up to the capabilities of organizations, particular projects and people in them. As Sarah Douglas puts it, *you can lead developers to water, but can you make them drink?*[40]

5.7 Prototypes and interventions: design as a political perspective

Clive Seale asserts that qualitative research is fundamentally a *craft skill* driven by local, practical concerns with the ambition of meeting particular audiences and their expectations. (Seale 1999: 19-31) However, as Seale comments:

> *A good study should reflect underlying methodological awareness, without this awareness being continually made explicit so that it is a screen obscuring the artefact itself* (Seale 1999: 31).

Instead of promoting specific methods or schools of research, the purpose of this study has been foremost to address design-related audiences, with the aid of *methodological awareness* (Seale 1999: 31) rooted to ethnomethodology and conversation analysis. Thus, my final reflective point relates not so much to the research tradition, but to the discipline of design.

In design, we seldom study the world as it is, but as it might be, given a piece of technology or design. Building prototypes and studying their use is a key means for data generation and data collection in design research. Design projects typically aim at propositions about how things could be. Instead of abstract speculation, prototypes are practical ways of guiding thought towards the future. They are informed guesses; arguments or rhetoric in material form about some conditions in the technological time to come (Buchanan 1989; Redström 2006) and such proposal generation is the essence of design activity.

This causes certain complications for design research. As design research is explicitly creating proposals for the future, it necessarily takes a stance on whether what people are doing is proper or not. In this sense design is not value free, but a *political perspective*. However, design is not alone in this. Many research traditions in the humanities and the social sciences are explicitly political; for example, *feminist studies, cultural studies, action studies, organization development,* and other research orientations that have *an agenda* (Seale 1999). Just as these approaches aim at emancipation or liberation of its subjects, design aims at improving the life of consumers by providing better products and services. As designers propose alternative courses of action for people, their work is always politically motivated. The audience is also typically aware of the political nature of design proposals. For example, the audience often seeks for "useful findings" from their own perspective, whether technological, social, or aesthetic.[41]

In the humanities, political perspectives have been criticized precisely because such agendas legitimate a subjective approach to research and undermine issues of reliability and validity (Seale 1999). Therefore, when doing research in this context, we need to be aware of its political undercurrent, but this should not stop us from doing quality research about products and users. Neither should we, as designers, be taken over by overwhelmingly academic-scientific projects.[42]

One step towards a *constructively self-critical research community* (Seale 1999: 31) in design-research is distinguishing between analytic (user research) phases and application of findings in design processes. The analytic phase, for example, ethnography, should not be weighed by its ability to provide requirements that meet developers' contemporary practical interests (Dourish 2006). The risk is, as argued by Paul Dourish, that projects driven by the "*implications for design*" model postulate design as the end point of research, making designers the gatekeepers that weigh the value of ethnographic research and marginalize both ethnographers and the people they study (Dourish 2006).[43]

Based on the discussion above on what design does in organizations (5.6 above), I would elaborate the point made by Dourish and claim that we are in fact talking about the "*implications for design*s" model, as it marginalizes not only ethnographers, but also activities designers are involved in. In addition

to understanding of human interaction with products and other humans, we also need awareness of how such understanding is turned into designs in organizations. For example, Article 1 discusses the intensive dialogue and negotiation that formed around design proposals. User research findings and user requirements are potential material for similar *chopping* and *re-specification* when exposed to a larger audience in the organization.

Today, the discipline of industrial design is largely defined by those outside the profession. Sensitizers, such as the framework of EM/CA, not only help in everyday design work related to social products and services, but also provide means for self-reflection within the discipline.

6. NOTES

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1. Cf. Nielsen (1993); Preece et al. (1994)
2. See Crabtree (2003)
3. Although Article 4 presents one example from an office environment, it is not about office work.
4. For detailed description of data, see Appendix — and articles.
5. For the notion of emotion and hedonistic psychology, see Jordan (2000); Blythe and Wright (2003). There are even conferences built on the emotional argument, for example Designing Pleasurable Products and Interfaces (DPPI) and Design and Emotion (D&E)
6. For example, 'policemen' arrest wrongdoers, 'waiters' take orders for food, 'secretaries' answer phones, arrange meetings etc. (Crabtree 2003: 27)
7. As an example they display a photograph of a middle-aged man with his horse, on top of which we can easily build a bundle of theories. Unleashing our imagination could result in hypothesis about the date of photographing, the location, the man, his personality or his doings before and after the photo etc. Still, as Berger and Mohr conclude the play: The most definitive information this photograph gives is about the bridle the horse is wearing and it is certain it is not the reason it (the photograph) was taken (Berger and Mohr 1995: 86).
8. The city of Tampere is known for its industrial history. Therefore it is sometimes referred to as the Manchester of Finland, i.e. Tampester.
9. Heritage (1984: 106-110) provides an example of greetings to illustrate how actions reflexively and accountably redetermine the scenes in which they occur (Heritage 1984: 107).
10. In fact Sacks (1995) occasionally uses invented examples, e.g. to illustrate how other sorts of responses to previous utterances would appear problematic for the participants. However, the argument being built is based on excerpts from actual talk; invented examples are used merely to elaborate why the observed course of action was given preference by the participants.
11. Based on a quote from the Design Manager.
12. See also Article 6 and the Lammassaari story
13. Sacks has noted that when people tell stories, they often announce the ordinariness of these events, for example "He's nice, he's very very nice", or: "we went to Palm Springs. Bud played golf with the guys and I sat around the pool with the girls." (Sacks 1995: 216). Even when something unusual or extraordinary experiences (committing crimes, doing drugs) do take place, they are often reported as utterly unexceptional, i.e. as such that are usual to those who've done it. People either report that "nothing much" happened, or if something indeed happened, it is reported in a way that turns it into "nothing much". (Sacks 1995: 218-219) Doing otherwise and making one's life into an epic by e.g. reporting details of some event might make the teller look as if she is trying to seem important. (Sacks 1995: 215-221)
14. More straightforward patterns of consideration are observable for example in email etiquette or list mail systems. Jokes or other unimportant bulk messages can be marked by starting the subject line with "[SPAM]". List messages typically start with bracketed name of the list, for example "[jatkokoulutus]". These hints indicate that these messages are less likely to contain personal or otherwise urgent material and therefore need not be immediately read and/or replied to.
15. Note also that this does not include implicit (for example thematic) linkages between messages. Some statistics about thematic linkages are discussed in (Koskinen and Kurvinen 2002)
16. See Laursen (2005) for further elaboration of this "rule".
17. Concerning reciprocity, there are notable differences between photo sharing systems. MMS or other direct person-to-person messaging applications are different to for example blogs or other Internet posts, where the material is rather made generally available than directed to any particular individual.
18. In the digital domain the other participants can also be co-located or remotely present or they may have retrospective access to current doings.
19. Why wouldn't it, as the roots of the approach are there.
20. I use the word "paradigm" here in Merton's sense, i.e. as a compact arrangement of background assumptions, central concepts and procedures that promote analysis and its communication to the audience. (Merton 1968: 69-72)
21. For example, people make jokes about the situation: "hereafter everything you say can and will be used against you!" (A joke I have heard several times)
22. Terms "emic" and "etic" were originally coined by Kenneth Pike (1967). "Emic" refers to descriptions of behavior using the vocabulary of the actors, while "etic" descriptions gloss them in words meaningful to the observer.
23. As put by Alasuutari: "A specimen may be badly representative of the whole, or it may be technically bad, but it cannot lie." (Alasuutari 1995: 63)
24. For the general discussion on reliability and validity in qualitative research see Alasuutari (1995); Seale (1999). More geared towards CA, Peräkylä (1997) provides and account on reliability and validity in research based on tapes and transcripts.
25. for example mGroup (Jacucci and Salovaara 2005), MobShare (Sarvas et al. 2004), MMM (Van House and Davis 2005) and various Flickr.com uploading tools, for example Merkitys-Meaning (http://meaning.3xi.org/), ZoneTag (http://zonetag.research.yahoo.com/) or Context Watcher (http://portals.telin.nl/contextwatcher/)
26. For a slightly mean yet insightful parody of technical UI conference paper choreography, see Henry et al. (1991).
27. For example tagging systems, currently popular within the so-called Web 2.0 movement may seem promising, but this does not mean that all tagging schemes or interaction designs with tags will breakthrough.
28. Although MMS did not break through (at least yet), observations we have made about human interaction in MMS messages are still most relevant to systems that enable similar interaction or have conversation-like features.
29. For example, will the consumers like some future service that is prototyped today.
30. See also Becker (n.d.)
31. For example, conversation analysts are accustomed to regular data workshops. They also maintain collective data archives for sharing recordings and transcriptions with other researchers.
32. Including the time that was needed to produce near CA quality transcription of four hours of videotape.
33. This does not mean full time work, but the study was conducted parallel to other research and university-related activities.
34. The term was originally coined by Garfinkel, who designed simple experiments that would make commonplace assumptions visible. For example, his students, when involved in ordinary conversation with "a victim", would insist for clarification of some commonplace remarks, e.g. "how are you". Such events immediately led to conflicts, revealing that vagueness is a sanctioned property of such expressions. (Garfinkel 1967: 36-53)
35. Typically corrective actions one should take based on research findings.
36. For example, if there is no transparency, there is no ensuring that designers work for the benefit of the user, instead of e.g. hidden organizational or personal agendas. For discussion on steps toward objective yet empathic design research, see Koskinen and Battarbee (2003: 44-47).

37. For example, in Article 5 we suggest that the system could support local human reasoning by enabling the user to follow what the others participants (individuals or large crowds even) are looking at the moment or e.g. in average. This then is not only a GUI representational challenge, but also an architectural one as it may be beyond the traditional server-client scheme that also this system was based on.

38. While doing the MMS study, we suggested to the mobile operator that they should focus on selling the second message. Our argument was that comparing to text only, photos contain more material for the recipients respond, comment and add on. If the consumers could easily and without extra cost add photos to their text messages (just because it is free), these photos might generate enough responses and network traffic to pay back the investment. This would mean marketing MMS as an improved text message ("now with photos"), and keeping service portfolio simpler so that the consumers could focus on using the messaging services without having to follow the pricing schemes of largely overlapping products.

39. Legend: [1] Mobile Image study, [2] Between project, [3] Wireless Imaging study, [4] Radiolinja MMS Pilot, [5] Case Metso Minerals, [6] MobiLife WAMG prototype.

40. Douglas, having introduced the transcription framework used by Suchman (1987) to developers, shows that yes, you can make some of them drink. (Douglas 1995)

41. In addition, developmental projects can be very large, complex and distributed, which brings in compartmentalization and agendas of the partner organizations. (Kurvinen et al. 2006)

42. To take an historic example, the Design Methods movement gained substantial amount of popularity for a time, but was finally loved to death by people who thought that designing is — or it should be turned into — a completely rational, transparent and explicable process (Jones 1984: 13–27; Mitchell 1992).

43. Furthermore, insofar as such requirements remain abstract, they are not very useful in particular tasks project teams meet (Säde 2001).

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8. APPENDIX: DATA

8. APPENDIX: DATA

This appendix provides a brief overview of the data. For details, see the articles.

8.1 Metso Minerals

This study is based on ethnographic research and 12 videotaped project meetings of a design team at Metso Minerals. The purpose of the meetings was to coordinate the work between the external industrial design consultant and the in-house team of engineers and process and marketing experts and managers. The total number of participants at the meetings varied from 5 to 8, with the exception of the kick-off meeting that consisted of more than 15-20 people. The average time between the meetings was 20 days. In addition to the consultant, another industrial designer, the design manager of Metso corporation, participated in the meetings.

8.2 Mobile Image study

In this study, user groups of five people were equipped with Nokia Communicator (9110) and IR-capable (Casio) digital cameras and free SIM cards from the operator. With these tools they could take photos and send them immediately as email attachments.

Each group attended a two-hour training session arranged at the Department of Product and Strategic Design, which concentrated on how to use the camera and the Communicator to send messages. Visual material was collected as e-mail attachments. Every Communicator had the e-mail addresses and phone numbers of the participants pre-installed and an email-list for the whole group. The participants were asked to CC: Esko Kurvinen whenever sending messages.

- *The pilot group* consisted of researchers from the University of Art and Design Helsinki, four men and one woman (three industrial designers, two sociologists) (*1961-1973). The duration of the experiment was 30.6.1999-31.12.2000
- *The male group* constisted of a group of five friends, university-level business and engineering students/graduates already in jobs (*1973-1975). The duration of the experiment was 2.3.-8.5.2000
- The female group was a groups of five friends, also students of social sciences at the University of Helsinki (*1973-1976). The duration of the experiment was 17.5-3.7.2000.
- *The control group* consisted of five friends and work acquaintances, designers working in new media (training in design and technology) (*1977-1979). The duration of the experiment was 14.12.2000-15.3.2001.

The pilot group sent about 500 visual messages in one month. The analysis in Koskinen et al. (2001; 2002) concentrated on the male and female groups, which sent a total of 371 e-mail messages (258+113) during the experiment. A single message contained 1 to 16 pictures. Although the female group sent only half as many messages as the male group, the messages they sent contained a larger number of pictures. Both the male and the female group members tended to include several pictures in a single message, especially towards the end of the experiment.

8.3 Wireless Imaging study

In 2002 we conducted a concept study for Nokia Mobile Phones. We organized a setting in which we gave groups of people ten i-Zone Polaroid cameras and a PVC-covered album template. People could cut, paste, and glue their Polaroid stickers on it and simultaneously see what others did with it. The first session took place during a one-day picnic party at *Suomenlinna*, an old fortress island and a popular recreation spot located 15 minutes from Helsinki. The participants were 13 Finnish language students at the University of Helsinki. The second part of this study was conducted at an indoor party with 20–30 guests. Photographing and completing the template took place during a single evening.

8.4 Radiolinja MMS Pilot

The MMS messages discussed in Articles 3 and 6 are extracted from an MMS pilot study by the Finnish mobile phone operator Radiolinja. The pilot study was carried out in summer 2002, just before the launch of the actual service. The pilot users were recruited by the customer service of the operator. At this point they were informed that we would be viewing and analyzing their messages. The users in each group knew each other before the study.

All study users were given a mobile phone equipped with a camera and the means to send and receive MMS messages for free. Amongst a total of 100 test users, 3 user groups, a total of 25 users, were selected for a more detailed qualitative study. In co-operation with the operator, we collected all the MMS messages of the test groups. The length of the pilot study was 27-37 days, starting

from the day the user picked up the phone from the operator. During the study, the 25 users sent 4159 MMS messages, of which 2098 were unique messages, the rest being duplicates sent to multiple recipients.

8.5 The Between project

The data discussed originates from the Between product concept development project, during which among other activities, we "shadowed" the recruited volunteers, observing (and occasionally videotaping) their everyday doings at work, home, etc. The duration of the shadowing exercise varied from one day up to a full work week in the office case. The cases discussed are based on these observations of individuals, although (as can be seen in Article 4), during their day they interacted with many other people.

8.6 IST MobiLife / Wellness-Aware Multimodal Gaming System

The prototype was user tested at a football practice session, where the team with coaches and family members were gathered. In the prototype evaluation setting, the players wore heart-rate belts and spectators standing beside the field (now restricted only to parents and coaches) had a mobile device on which they were able to view the sensor data. On site we had six mobile phones with the application installed. In addition to the mobile phone UI, one laptop was provided to allow viewing of heart-rate data graphs of several people simultaneously on a big screen.

The data was received in real time. With the application it was also possible to watch a history of data from the last three minutes for an individual player in graph format.

No access rights were imposed, meaning that the sensor data from all players was accessible to everyone. The duration of the practice (and the test) was roughly 1.5 hours.

On site, we had three types of user:

- Players. Eleven teenage boys aged 14-15 wearing the heart-rate belt sensors. The number of players at the practice was 25-30.
- Parents and family members of the players. As some arrived late and some left earlier, the total number of parents present varied from 8 to 12 (some arrived late and some left early).
- Coaches. During the session, the head coach and the assistant coach were mostly on the field with the boys. A third coach, also the team manager, was using the system together with the parents next to the field. The main coach and the team manager were also interviewed right after the test session.

Our analysis is based on combination of semi-structured questions asked beside the field and ethnographic observations, including field notes, as well as analysis of transcribed videotapes.

ARTICLES #1–6

ARTICLE #1

HOW INDUSTRIAL DESIGN INTERACTS WITH TECHNOLOGY: a case study on design of a stone crusher

Esko Kurvinen
University of Art and Design Helsinki

This paper takes an empirical look into industrial design in process and metal industries. The data are based on a case study of an industrial design pilot project at a company that is a market leader in mineral processing systems. In the paper, the overall structure of the project is outlined and aspects of design work are addressed through detailed analysis of interactions between the participants. In addition, the role of visualizations and the nature of design problems are examined. The conclusions of the paper include implications for the organization of industrial design projects. In addition, general notes are made about the nature of industrial design within the company – and technology intensive areas in general.

Keywords: Industrial design; Design management; Best practice

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Best Young Design Researcher paper at
the Design 2004 Society Conference in
Dubrovnik, as judged by a panel
in which Professors Marjanović, Birkhofer and
Andreasen were included.

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1. Introduction

Industrial design is perhaps better known from the field of consumer products. Currently, industrial design is also entering the field of mechanical engineering in process and metal industries. Metso Corporation, the company under focus in this study, produces process industry machinery and systems and has utilized industrial design for more than 30 years. Metso has outlined industrial design as one of its strategic assets, and across its subsidiaries there are several successful examples of it use.

The key statement of this article is that the benefits of industrial design are not automatically realized as a result of well-informed strategic decisions and resource management. Processes and formal structures are not enough since each project also needs to succeed on the level of the most ordinary interactions. Efficient project practices are therefore needed before industrial design can become a strategic asset.

The purpose of this paper is to outline critical settings and situations that should be taken into account when industrial design is introduced to engineering-oriented product development. It is based on a case study of a design project organized at a subsidiary of Metso Corporation. It describes the work between the company and an external industrial design consultant; how the project proceeded and how designs were discussed and evaluated. My purpose is not to evaluate the designs or success of the project, but to dissect the working methods in one product development project – keeping in mind the strategic position and history of industrial design within Metso.

Also, I do not intend to generalize my findings. Instead, this study remains localized in the sense of the principles of *action research* (Stringer 1999: 6–7, 167–168). I will describe some aspects of the social life that existed for one particular team – and leave it for the practitioners in design to discuss how well the case represents first encounters with industrial design in general.

Meetings are inherently social situations. Thus, there is always the possibility for objectives to break down at the level of mundane interactions (Boden 1994, Koskinen 2000). However, more important than the success of one project is whether, as a result of such a project, the working practices of the team develop for the benefit of future projects.

2. Data

This study is based on videotaped project meetings of a design team at Metso Minerals. Metso Minerals produces stone crushers for a wide range of applications including quarries, road construction sites and recycling of demolition debris (*i.e.* concrete, bricks and asphalt).

The purpose of the project was to design a new stone crusher (figure 1). At the launch of the project, Metso Minerals had no internal industrial designer and an external design consultant was commissioned for the project. Although Metso Minerals had engaged an industrial designer in a smaller project few years earlier, for this team the project was their first experience with industrial design. In addition to the design consultant, the design manager of Metso Corporation, also an industrial designer, participated in the design meetings.

Obviously, design meetings at the beginning of the project were somewhat different to the later ones, when the key features of the design were fixed. In this paper I focus on the meetings at the beginning of the project, because I believe they offer a prototypical example of initial contact between industrial designer(s) and engineers in a technology intensive context.

At launch, the project was given several ambitious goals. (1) The industrial designers wanted not only to raise the quality of the product, but to re-organize the work. They made a clear distinction between *re-design* and *design*. In a *re-design* key properties of the product are defined and the looks of the product are improved by superficial means. In *real design* the functional key principles are outlined first and details are not touched until there is a clear design vision of the product (Lawson 1997). It was agreed that this project would not be a mere facelift. (2) The project was a design pilot; it should serve as an encouraging example of utilization of industrial design at Metso Minerals. At Metso, pilot projects are instruments for disseminating knowledge across subsidiaries. (3)

Figure 1. The stone crusher

The Industrial Design Working Group. How industrial design interacts with technology 375 of Metso communicated that the project should not focus on current problems only, but also create a future vision of the project. (4) The outcome of the project would be not only a concept, but also a real working product that going into production at a given date. (5) The manufacturing costs of the stone crusher should be reduced. At minimum, a better-looking and better-functioning product should be built with the same amount of money. This would be achieved by reducing the number of parts and each part performing more tasks than before. The approach had proven successful in, for example, in paper machinery designs within Metso Paper.

The project started with a meeting between the consultant, project manager and engineering manager. In this meeting the product and aims of the project were roughly introduced to the consultant. Based on the meeting, the consultant wrote a memo that also performed as an initial design brief for himself.

Because the product is quite complex, during the briefing it was split into functional subcomponents. These included, for example, the engine module, frame, crusher, working platforms, and so on. Some of the components were designated for other projects and the consultant only received the external dimensions of the components that he should accommodate.

3. The structure of the design meetings

The first meetings after the design brief were very similar. The consultant had created some designs at his office and he presented them to the team. There was a three-part structure to the meetings.

First, the consultant presented the key features of his designs with illustrations and animations. Others mainly listened and asked only short, specifying questions. At each meeting, the consultant usually had more than one design to present. Instead of showing details of designs, he displayed illustrations of complete stone crushers. Quite often, he used animations to illustrate how some of the moving parts function (*e.g.* how doors and shields open).

Second, the team discussed the details of the designs, pros and cons of some of the solutions. After the concept introduction, the conversation started from this entity towards particular features or details of the design. In these conversations, some of the design solutions were identified as developable while others were considered impossible to carry out. The team evaluated mostly single, concrete

components. The value of the crusher concept as a whole was seldom addressed, except when some clearly visible feature labelled the whole design.

Third, the conversation was summarized and the consultant was given a new brief. Again, it was the consultant who built the brief. He summarized the discussion, turning it into a brief. The brief was then either accepted as such or approved by the team with some adjustments.

At the end of each meeting a time for the next was agreed. The average time between the meetings was 20 days. Immediately after the meeting the consultant wrote a memo with special emphasis on the brief, and emailed the memo to the team. As a result of the design meeting, the concepts were split into pieces, and the developable ideas were sorted out. The consultant then combined this set of ideas into new designs for the next meeting. The most concrete outcome of the meeting was the new design brief based on the evaluating conversation by the team. The updated brief was prospective in nature, listing the conclusions but not the reasoning behind the design decisions. Although the meetings were labelled as industrial design meetings, most of the time the team handled issues related to the expertise of the participating engineers. Perhaps this is typical to this type of industry. If so, how is the industrial design approach visible in the details of the actual work?

3.1 The opening statement

The industrial design approach was most visible in the opening statement of the design consultant. The opening statement brought the overall tone to the meetings (Boden 1994). Due to confidentiality issues, I have omitted those parts of the transcriptions that describe design ideas.

Example 1

Consultant: Well, we are now in the phase that we have received a message from the big guys at the headquarters that we should raise the profile of the design. And I'm sorry I have perhaps approached this too engineer-like and too seriously. That there is not enough the spirit of (–). But I am happy we are aiming for features like this (–) and (–). The ideas in this [animation] are about the (–) [feature).

The opening statement began with a review of the current status of the project, including the received feedback from the previous meeting and suggestions from the Industrial Design Working Group of Metso Corporation. This led the team into examining the key features of the current design.

3.2 Design as a topic in conversation

After the opening statement, design as such was hardly ever raised as a topic of conversation. The fact that it was a design meeting became visible through negative cases, when it was clearly stated that this particular issue was *not* about design. This was achieved, for example, by framing part of the conversation as *non-design*. In the following example the project manager opens a 10-min conversation on the screening system at the feeding end.

Example 2

Product manager: Could we check the… those issues so… I have to leave soon.
Project manager: Yes – we have this type of technical problem here…
First, we have the [walks to the flip board].
[conversation on the screening system, 10 min omitted]
Project manager: I don't have any more open issues but I guess related to design we have lots of interesting questions.

In example 2, the product manager is about to leave the meeting. Earlier he had discussed the screening system issue with the project manager, with whom they now suggest this as a topic for conversation (lines 1–3). The project manager marks the topic as a technical issue (line 2) and during the following 10 min the designers do not participate in the conversation. When the screening system problem is finished with, the project manager turns the focus back to design (lines 5–6).

Design questions were mostly handled in between technical issues. The symbiosis of industrial design and technology was observable in attempts made to talk about design alone. For example, on occasion the engineering manager asked the participants for purely aesthetic or general assessments about the design. Questions that were too abstract were typically followed first by a very long silence that escaped only through a technical or more detailed viewpoint. For example: 'the one with the groove on the side might be good if these stairs are moved to the front' or 'this could work also in the 320-series crusher'. Design talk was notably difficult in the beginning of the project although later some engineers encouraged themselves to talk about even purely aesthetic issues. Learning was a two-way process. According to the design manager, industrial designers, internal and external, learn the constraints and possibilities of the technology in conversations within similar projects all across Metso. He clearly prefers this learning by doing approach. It is not only that individual projects meet their deliverables, but the engineers learn to utilize industrial design in their future work, while designers acquaint themselves with the technology.

3.3 Design inspiring topics

As mentioned earlier, for the engineers of the team the project was their first contact with industrial design. Perhaps that is why, instead of opening new possibilities for design, the conversation often focused on the aspects of the current design under evaluation. In short, the consultant visualizes his ideas and the engineers evaluate the details of the designs within a freely flowing conversation.

Example 3
Consultant: I have some transparencies here, should we take a look.
[Engineer puts transparencies on the projector]
Product manager: Its upside down.
[Engineer flips the transparencies]
(8.0)
PM: It was better upside down.
[Laughter]
(26.0)
PM: What material are the (1.0) shields made of?

In this example, the design consultant has just finished his opening presentation and the conversation has not really started. After the consultant places the transparencies on the projector, the whole design is under evaluation only for a while – in deep silence (lines 5 and 8). After the silence, the conversation begins on the material of the shields. There was nothing especially new about the shields and the conversation could have started on any feature of the design. After the shields discussion, a new topic is found. Again, what is to be selected after any topic is based on at least two resources: the visual representation of the design and whatever was said about the previous part under evaluation. Design inspired a series of conversations on technological matters. Although, for example, market and end-user information was often referred to, documents or other material from these areas was only seldom presented. While the freely flowing conversation generates ideas to some problems, it is possible that the conceptual and systemic aspects of the design are neglected. If so, an essential part of the substance industrial design is supposed to bring in is at risk of getting lost in the details. The product, the stone crusher, and its applications are so complex that, for any given part of the design, it is possible to raise a nearly infinite number of constraints and criteria for evaluation.

3.4 Design summarizing topics

After a discussion on a topic, the design consultant often summarized the conversation into a preliminary design idea. In the following example, there has just been a lengthy conversation on the side conveyor, about its structure, transportation and whether it should be left-handed or right-handed.

Example 4
(5.0)
Consultant: So am I getting this right, there is a short belt as wide as the frame that unloads to either side and from there the material goes . . .
Engineer: No that is part of the conveyor.
Consultant: But could it be like that? then we could put the conveyor to either side.
[. . .]
Product manager: The potential problem is where (–)
It is not impossible.

The consultant starts his wrap up with a specifying question (lines 2–3), followed by a design idea for the structure of the side conveyor (line 5). The idea is described as possible to implement, on condition that some details can be solved (lines 7–8). After the conveyor issue the conversation moves on to the next topic. The consultant summarizes the side conveyor issue into his memo as follows:

– Side conveyor, 6m long, unloads 50/50 right/left, must fit in the transportation, width?

As already mentioned, the memo was mostly a to-do list for the consultant himself. Although the memo was e-mailed to the group, the other members hardly ever corrected or commented on the memo in any way. The memo was reacted to only when it contained some direct questions. In summary, the design consultant summarized the conversation in three ways. First, as already presented, he summarized some of the topics already in the meeting. Second, in the memo, he listed some of the issues treated in the conversations. The third, and perhaps most important tool, was the static and animated visual representations.

4. Virtual models and visualizations in the design meetings

The industrial design meetings were structured around illustrations, virtual models and animations, and only seldom by agendas or other documents (see Koskinen 2000). In product development, as noted by Kathryn Henderson (1998), models and illustrations enable the integration and development of the perspectives of the individual participants. With images, professional skills and expertise can also be manifested (Ochs *et al.* 1994). During the meetings not only the designers but other participants also copied the presented illustrations and sketched new ideas into their notebooks. Images make useful and natural documents of the handled issues and they are the bases for evaluation of design ideas. Despite of all the advantages, images have also their downsides.

Figure 2 illustrates how the participants, with the aid of the virtual model, travelled around the crusher in one particular half-hour conversation.

The path around the machine is not random but most logical. First, the conversation jumps from one physical part to another. Second, there four ways to make the jump from the part currently under evaluation to the next one. Imagine a situation in which we are currently we are talking about part X. After X we will talk about either:

(a) an item that is physically next to X;
(b) an item that is related to X in some other way;
(c) an item mentioned by the previous speaker; or
(d) an item that is 'other than X'

In (a), (b) and (c), the new topic is contingent on the previous part under evaluation. In the process, the virtual model projected to the wall is not only the key source of new parts to pick and evaluate. In addition, it also provides a frame of reference of the scale and style in which the parts should be discussed. For example, if details are presented, people are given the permission to speak of the details. Although I have not made any systematic coding of the activity, my impression is that (a), (b) and perhaps (c) are among the most used techniques for selecting new topics (see also Sacks *et al.* 1974). For the participants, it is most convenient to just go along with the flow of the illustration-inspired conversation. This is in contrast, for example, to case (d), where the next speaker needs to explicitly suggest a newtopic not directly connected to previous (see also example 2). Thus, given the *ad hoc* nature of the conversation, what do the participants get out of it?

In technology-intensive industries, one key aim for industrial design is to locate and create connections across dispersed and large entities. An industrial designer may have to be aware of a large set of constraints across the lifecycle of the product (Gotzsch 1999). Despite the holistic approach industrial design seems to have authority over aesthetic aspects only. Authority over the visual appearance of products is quite problematic. It covers everything that companies produce, but nothing that could be explicitly defined beforehand. Whenever the designer concretizes the looks of the product, he is bound to drift into an area that is not his expertise. Since visualizations are inherently open-ended, it is impossible to predict whose realm he/she is about to enter – and how do those who claim its authority perceive this entry?

Both the strength and weakness of industrial design lies in visualizations. Images can be used to present far-reaching concepts of how things could be in the future. Sometimes visual scenarios develop into self-fulfilling prophecies that shape the future of the organization (Henderson 1998). However, visualizations rarely weigh as evidence and are a nearly infinite source of critique and reservations.

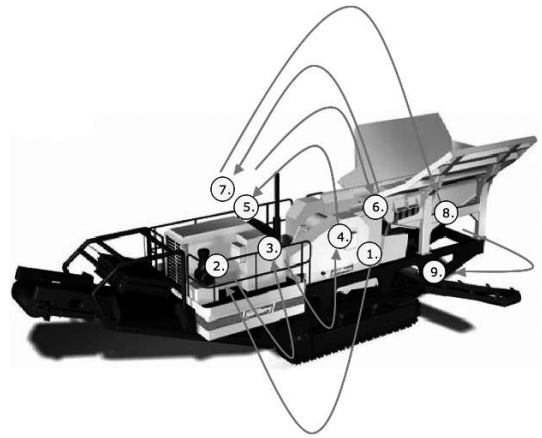

Figure 2. The physical path around the design in one conversation.

5. Interaction and the nature of design problems

Normatively thinking, activities should be evaluated against their pre-defined objectives. This case had five goals: thorough and appropriate process forworking, successful and encouraging design pilot, future-oriented vision, functioning new stone crusher, and reduced production costs. Whereas the first three goals are open to various interpretations, functionality and production costs would come into view very concretely, and possibly carry more weight.

How are individual design proposals evaluated in practice? Industrial design literature proposes that design work should be steered by specifications from early on (Ulrich and Eppinger 1995). In the beginning of the project the designer should be given *all the relevant information* about the product. However, too much information may block fresh ideas. The balance is critical since the need for original, never-thought-of ideas is one of the key reasons for externalizing design (Kristensen and Lojacono 2002).

What is relevant and what is not? In the case of Metso Minerals, the consultant was expected to create new ideas for the frame of the crusher. In the second meeting he suggested a design where the straight diagonal beam of the frame at the feeding end of the crusher was replaced with an arc-shaped construction.

In the meeting the proposal was criticized from multiple angles. The product manager said the arc gets in the way of backing up the crusher close to the gravel heap. The construction engineer suspected that the bottom end of the arc is structurally weak. The project manager pointed out that the solution would not allow alternative transportation on trucks. Following the overkill of the frame idea, the industrial designers started to complain about the way the activity was structured.

Example 5
Design manager: It's a bit troubling that these surprises keep popping up.
Consultant: Yea, and then the designer feels really stupid.
Design manager: Wasn't I stupid 'cause everybody else knew and I didn't. It's a really slow way to proceed that you do a proposal after which the group says that its ok but its not ok
Engineering manager: Its kinda –we don't really have a complete description what you can do with the machine and how it works . . .
Engineer: We also like you don't notice all the constraints you have to take into account and then someone remembers that this also must fit in . . .

Lack of information cannot be completely removed by providing more information. First, giving *all relevant information* might block fresh ideas. Second, design question or problem is often found only after a proposal is made (Rittel and Webber 1984). There was no problem with the detachable trucks until the consultant suggested a design that was internally logical yet in conflict with a use situation unknown to him. It is not only that an exhaustive description of what the product does might be hard to accomplish (lines 6–9). In addition, it is impossible to put together a list of all functional properties of all possible future designs of the product. Thus, some of the constraints of design are found only by designing, and evaluative criteria cannot be completely listed in the beginning of the project.

But surely there must be something on which to base the design evaluation? In the stone crusher project, the key source of criteria was the previous version of the same product. Although I have no evidence on which to base generalizations, it would be tempting to claim that this pattern is very common in design.

The previous version is not a straightforward measuring stick against which candidate designs are evaluated. Instead, just like the new design, the old one is an equally indexical resource for interconnected sets of topics in the conversation. When benchmarked against the old version, the new design is a defendant in many respects. Take, for example, functionality and production costs. While Metso Minerals is already a market leader in stone crushers, there is no evidence that the new version works. Also, production lines are adjusted to the current product and changes will cost something.

The new design had to defend its existence, which often accelerated the pull towards technical details. Repeatedly, a proposed design was rejected because it was in conflict with external dimensions of some component in the current design. Seeking alternative solutions to this component or module was not always possible. Some of the components were fixed because they were passed to

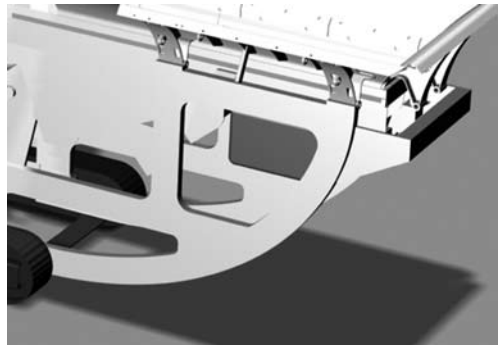

Figure 3. Detail of the frame design.

subcontractors, some for no particular reason, and some key components were not to be touched because they were commissioned to another project. In one meeting the design team could not fit protective shields inside the maximum dimensions for road transportation and they had to visit another team to bargain for 50mm more space.

In many ways design work in a technological context is like putting together a puzzle. The designer has to use a set of pieces to create an entity. Alas, just like in a puzzle, the best fit is achieved by putting the pieces exactly as they were before. Therefore, the worthy input of the consultant was at the end directed mostly to areas outside the key components of the crusher (*e.g.* to shields and parts that open outside the transportation width). This was not due to great design potentials in these areas, but because these areas were available since no one else operated there.

6. Implications to the organization of industrial design projects

Studying human interaction is a topic of analysis in its own right. In this article I have shown how we can locate structures in apparently coincidental aspects of design work. I also suggest that companies utilizing industrial design should be concerned about not only appropriate organization and resource allocation, but also the caveats hidden in mundane interactions – as non-interesting as they first may seem.

What needs to be taken into account when starting industrial design activity in a technology intensive area? First, as design literature suggests, the process should be started early enough. It takes time for the designer to learn the technology just as it takes time for the engineers to familiarize themselves with design.

Second, the organizational position of the project is important. In the case of the crusher, the work of other projects affected the product. The responsibilities and decision-making power between projects was distributed in terms of the physical geometry of the crusher. Thus, the design project had to tack in-between and outside the frozen modules. Creating a product that is perceived as an entity instead of a collection of independently designed items is especially difficult if most of the key areas of the product are frozen not only by geometric constrains, but also by organizational division of labour.

Third, not all design projects are the same. For example, product concept design projects are quite different to projects customized to the needs of a particular client. A key question is: can the project afford to fail? Concept creation is about forgetting old solutions, even at the risk of not achieving anything useful. This is seldom possible with client projects. There is no orthodoxy in product development, but perhaps not all types of expectations should be loaded on one project.

Fourth, you cannot brief a designer hoping he will return with a solution after a month. Iteration is important, especially in the beginning of the project. In the stone crusher project the consultant worked at his office, collecting feedback in the meetings. The average time between the meetings was 20 days, which obviously created lots of practical problems in the project. However, a potential cure to these problems was very near. Parallel to the design project, another project had commissioned an engineering consultant who worked together with the rest of the team at the premises of Metso Minerals. Similar arrangements would be most appropriate also for industrial design work. Instead of gathering the whole team to criticize impractical design ideas, they could be easily rejected within informal coffeebreak conversations. Another approach would be that someone inside the company takes responsibility over the consultancy, perhaps even works in their premises, to enable frequent interaction. Either way, since it is typical that a lot of the business in engineering design and manufacturing is already handed over to subcontractors, companies surely have some cooperation arrangements that can be used also in the industrial design projects.

The fifth challenge relates to the visual tools. When an old version of the product is available as a three-dimensional virtual model, it is tempting to start designing on top of that. However, this places preliminary and fragile design ideas parallel to current solutions, which encourages the participants to locate conflicts between the two – instead of seeking potentials in the new design. Imprecise representations, process instrument schemes, written documents and lists can help the participants to forget the current design for a while.

Sixth, the meeting practices can be improved. A chairperson who is not personally involved in the project work can better steer the conversation away from the details. Also, the design team should be allowed to reorganize their work when necessary.

In this paper I have touched on several items relating to the management of design projects: briefing, scheduling, power of decision, distribution of work, quality of feedback, pace of iteration, and so on. The people I observed were not blind, but were generally reflective on most of these items. Although in the project there was no slot for addressing the organizational issues, the team was able to recognize and at least discuss them as they became relevant to their work.

7. Industrial design is a way of thinking

In the strategy of Metso Corporation, industrial design is a way of thinking. It is not submitted to industrial designers alone. Appropriate and efficient product design is not a consequence of education or organizational titles. Indeed, there was some evidence that new ways of thinking emerged.

In the crusher project, industrial design was a cooperative activity. Unfortunately, in the beginning of the project, the roles of the participants were rather fixed. The engineers used a great deal of effort to find out reasons why particular design ideas cannot be realized, while the consultant aimed at adjusting his designs to fit the emerging set of criteria. Later in the project this pattern started to change. For example, at one point two engineers of the design team re-designed key parts of the frame by combining several features into one component. Consequently, also a new visual element was created. Thus, the design not only served manufacturing (cf. the core of engineering), but gave the product a new functionalistic and aesthetic touch (cf. the core of industrial design). The new idea for a frame was inspired by a particular design meeting. In the meeting the team had a lengthy and non-productive conversation on this area of the crusher. Although the solution was not created in the meeting, the endless-looking conversation proved not altogether useless.

The consultant has similar experiences of other projects within Metso. He told how in a paper machine project a key design idea crystallized after similar conversations. The consultant does not even remember who it was that first articulated the idea. Neither does he see the issue of initial ownership important. In addition, after the project was successfully closed, the client developed the idea even further, merely informing the consultant about the progress.

According to the design manager, following successful industrial design pilots, some engineers do not want to work without industrial design or industrial designers anymore. At best, the industrial design approach sticks on like glue. Just like glue has no shape on its own, industrial design is moulded in action by technology, organizational constrains and structures of social interaction.

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ARTICLE #2

EMOTIONS IN ACTION: a Case in Mobile Visual Communication

Esko Kurvinen
University of Art and Design Helsinki

1. Introduction: emotions and interactive products

Emotions play an important role when consumers adopt new technology into their everyday life. Understanding emotional expectations and emotional responses that emerge during use will help us design usable, enjoyable, and therefore successful products. While the design community widely accepts the importance of emotions in consumer preferences, their interactional properties are poorly examined.

Usability and user centred design (UCD) typically places a lot of emphasis on the first confrontation between the user and the machine, including e.g. the learnability of the structure or the success of the terminology of the interface. As such, this orientation is unable to capture what happens in the course of time when products are gradually domesticated into our everyday life.

The aim of this paper is to study emotional responses as a socio-interactional phenomenon. I will present data from an experiment that prototyped one widevisioned feature of the so-called third generation mobile phones (3G). That is, capability to take, send and receive photographs using a mobile communication device.

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2. 3G and mobile visual communication

According to product development scenarios, mobile imaging will be the key feature of the mobile Internet. In the 3G mobile phone visions, the small portable devices of the near future are versatile in production, editing and sharing of images.

Though all the key players in this area pursue technological development, there are only few studies from the perspective of the end user. While the commercial breakthrough of SMS (Short Messaging Service) has only recently awakened us to understand the potential of social use, it remains to be seen if the key paradigm of 3G is also going to change. According to Pantzar (2002), the consumers will make the final selection between tools and toys.

3. Methods

This paper studies the production of mobile messages that are somehow emotional. Instead of extensive discussion on messaging in terms of emotions, I focus on the turn-by-turn making of meanings in messages. First, I will show examples of messages where users use photographs to represent their feelings or emotional state. I will also discuss the role of text in these messages. Secondly, I will show how in the context of communication, the meanings of a message do not arise from its content or intentions of the sender only, but are *achievements* in a co-operative activity.

My analysis draws from ethnomethodology (Garfinkel 1967) and conversation analysis (e.g. Hutchby and Wooffitt. 1998), both methodological orientations that focus on the sequential organization of social events.

3.1 Data

To get a glimpse on the possible uses of future mobile phones, we used today's off-the-shelf technology. We gave a Nokia 9110 Communicator and a Casio infrared-capable digital camera to four user groups and followed the way in which they used this package. Our study concentrated on consumer grade technology and everyday uses, not professional photography.

The equipment enabled our subjects to take photos and send them instantly as email attachments. With the Communicator, subjects were also able to receive

and view photos and comments while on the move. In practice, they most often ended up reading the messages on a PC because of the slow GSM connection and small black and white screen of the Communicator.

In 1999–2001, four groups participated in the study: a pilot group, a group of young adult males (born 1973–75), a group of young adult females (1973-76) and a control group. Each group had five members. The examples in this paper are from groups 2 and 3. For a full description of the data, see Koskinen et al. (2002)

3.1.1 Emotional Mobile Images

Some of the messages sent during our study were clearly charged with emotions. In the example below, Kirsi sends a picture of herself to her boyfriend, who is studying abroad.

Example 1
Subject: At your place
I came here to check out the storage room, which is really small by the way - and to give Toni the keys. So strange being here without you.
Kiki

In the message, Kirsi's longing for her boyfriend is communicated with a subtle combination of visual and textual means. She is intensively looking at the camera, or rather, mediated by the image, the receiver of the message. In the text, she is using her pet name and telling that her being at this particular place is not the same without him.

3.1.2 Interaction with Image and Text

Practically all of the messages sent during our study contained both images and text. Even in cases where text was missing, the author had otherwise quite explicitly linked the image to the previous message(s) or conversations outside email. In a prime example below, from the male group, text explicates both the content of the image and context in which it was taken.

Example 2
Subject: dishes
HELLO! Dudes check out this pile of dishes; oh sheet.
Some statistics: almost forty glasses, twenty mugs, a bloody load of plates. What a fantastic way to start Saturday morning.
Gentlemen, things are not fine right now!
- Ike

Typically, the sender provides the recipients at least some instructions on how to interpret the message. Most often these instructions were given in the text. As a result, the text-image pair of a message builds a frame of reference against which subsequent messages can orient to. Of course they need not do so, but if they are to continue on the same topic and especially if they are to discuss the first message or image in more detail, they often take it into account. Next example shows the reply that followed 20 minutes later.

Example 3
Subject: Re: dishe
Me too, the dishes hit the fan and just look at all those damn crappy plates... only 4 h to go, I am already parched...

The replying message was constructed using both visual and textual references to the first one. The replying photograph did not only present a visually similar view, it was also not taken until the first photograph was received and provided guidance on how to take a similar one. Style-wise, the text of the second message follows the first one, its strong first-person perspective and swearing projecting the unpleasantness of the situation.

Subsequent messages can also draw from the previous ones without having to entirely agree with them. In example 4, Lisa continues a monologue she has started on her childhood neighborhood. In example 5, a replying message from Minna oriented to what was presented earlier but turned it into something new.

Example 4
Subject: at the corner store

Continuing the Friday afternoon series... pictures from my childhood home store Valintatalo. Part1, Sami and a Baguette

Example 5
Subject:
I follow the series started by Lisa (man and a baquette) and challenge others to join. Here is a man and a paddle.
Minna

In Finnish, baguette (patonki) and paddle (mela) are both slang words referring to the male sexual organ. Though this type of interpretation was by no means necessary, Minna's invitation for others to join the series was built on this sexual tone.

The replying message altered the meaning of the original in two ways. First, in her message Minna utilized the subject of the photo, Sami. Since other recipients have no photos nor the desire to discuss him, a more general frame, men, still applicable to Sami, yet more interesting, had to be initiated. Secondly, Lisa's monologue may be uninteresting as such, but its established serialness is a legitimate justification for subsequent messages, even though herself Lisa never called upon this kind of theme.

Both of these transformations were done in order to better facilitate an invitation. Yet, this not simply a case of abuse or intentional misinterpretation. Looking at the dates of the photos, one notices that Minna's photo was taken before she received Lisa's message from the store. Despite of the photo of a man and a paddle being aesthetic, funny and useful as such, it was not sent until Lisa's message made it relevant in this context. It can be concluded therefore, that the two photographs, instead of one being inherit from the other, mutually defined each other in the turn-by-turn process of group communication

4. Discussion

The successful devices, services and interfaces of tomorrow's imaging phones may not be *themselves* emotionally charged. As I have shown above, each visual message is a potential resource for not only taking new photos and building new messages, but also for making sense of the preceding ones. Therefore, the meanings, fun and pleasure of communication that leads to our engagement in future mobile imaging services is by no means a take-it-or-leave-it. Rather, it is based on a continuous chain of retrospective-prospective comparisons between messages. Mobile imaging services should support users' activity at hand. Paradoxically, this is best done by giving users rich access to the local history of their personal and group-specific messaging, as well as storage space for images waiting for the suitable moment to be sent. Sending images to our friends is not a need awaiting fulfilment; it is a process that needs to be nourished.

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ARTICLE #3

ONLY WHEN MISS UNIVERSE SNATCHES ME: Teasing in MMS Messaging

Esko Kurvinen
University of Art and Design Helsinki

Abstract

When new technology is adopted to everyday life, existing patterns of behavior relevant to the application are transferred to this new media. In this process, some things will also change and evolve.

This paper takes an empirical look at mobile multimedia messaging. Within this new technological environment I focus on teasing, an established form of social control prevalent also in MMS (Multimedia Messaging Services) Messaging.

I draw from conversation analysis [15] and ethnomethodology [5]. My analysis describes the sequential structures of teases in MMS messages. I will conclude with discussion on the effects images have on mundane social conduct.
Categories and Subject Descriptors A.0 [General]: Conference Proceedings
Keywords Multimedia messaging, MMS, 3G, mobile imaging, visual communication

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1. Introduction

When new technology enters our life, it does not change things altogether. Instead, in order to succeed, technology has to fit the existing everyday practices. Usefulness of a technology, therefore, is not predefined but consumers and users have an active role in its domestication [14, 2: 6].

Still, some things will change. Patterns of use for new products and services do not simply replicate the ways we have done things in the past, but technological innovations open up possibilities for the users that ultimately define what the new technology is about.

Currently, following the success of text messages (Short Message Service, SMS), the first Multimedia Messaging Services (MMS) have been launched in Europe. Comparing to text messages, images undoubtedly open up new possibilities for users, but we have not seen any empirical studies on how these potentials emerge and are put into use by the end users.

2. Methodological orientation

2.1 Approaches to Social Aspects of Images and Mobile Messaging

To position this paper in research on social aspects of mobile messaging, I discuss briefly the underlying premises of a few studies. This short review is not to be seen as an extensive literature study, but a quick-and-dirty framework to illustrate the analytic stance of this paper.

2.1.1 Functional Approach: "What Is It Really About"

Taylor and Harper's study of teenage mobile phone users focuses on ritual exchanges carried out with e.g. SMS. They argue that messages are capable of carrying deeper meanings. They see these technologically mediated social exchanges analogous to gift giving, an age-old practice that people utilize to manage social bonds. [16]

Taylor and Harper join the old sociological tradition that – often implicitly and without methodic support as argued by Robert Merton [12: 73] – makes the distinction between manifest and latent functions. The basic idea behind *functional analysis in sociology* is that social activities that have observable structure, may also have hidden, deliberate or unintentional consequences

for the maintenance of a social organism. The size of the organism then, in sociological research, may vary from highly specialized groups to the society as a whole. [12: 73-138]

Notions of latent functions messages have are also implied in findings in the Maypole project [13]. According to the authors the use cases of a prototype pictorial communicator indicate that messages express affection and increase or maintain group cohesion [13: 552-553].

2.1.2 Content Orientation: "What Is It Used For"

The Maypole study also categorized messages according to their content. The authors labeled messages as *joking, storytelling, task-related, task-unrelated, family oriented* etc. [13]

An SMS study by Grinter and Eldridge [6], describe contents of text messages of teenagers as *coordinating activities, chatting, gossiping* etc.. A similar study on instant messaging (IM) by Grinter and Palen [7], sorts IM communication into *informal talk, socializing, event planning* and *schoolwork communication.*

It can be assumed that the three studies above utilize some version of *analytic induction* (term originally coined by Znaniecki [18]). In analytic induction hypothetical terms are drawn from instances of data, to be later tested against other cases until accurate description of the examined phenomenon is reached. For product developers, Contextual Design [1] provides the most extensive toolkit for analyzing user data in this manner.

Unfortunately, in understanding the actual phenomena, design oriented studies rarely go beyond labeling. This means that developed categories are not really tested against the data, or that the categories are so broad – e.g. *informal talk* above – that can be questioned if they really separate individual instances of data.

2.1.3 Technology and Mundane Practices: "Users as Innovators"

In a study combining in-home interviews, photo diaries and recorded *photo-talk,* Frohlich et al. describe what people do with photographs [4]. They analyze various practices people have e.g. for archiving, organizing and sharing of photographs. The study illustrates not only that people are aware of standard solutions in archiving photos for later use, but they have also developed these standards further to better fit their personal needs.

Similarly, a study by Kasesniemi and Rautiainen on the mobile phone usage of Finnish teenagers [8], emphasizes the active and innovative role users have in developing practices of use for the new technology.

Koskinen et al., in their study on mobile multimedia messaging with Nokia Communicator and digital camera [9], point out that imaging technology must be adjusted to the taken-for-granted patterns of everyday life. The authors address interaction from two perspectives. First, applying thoughts of Georg Simmel, they point out that social activity is reciprocal and does not need motives external to the activity itself. In addition, sociable interaction stabilizes between upper and lower sociability thresholds of the individual [9: 35-37]. Just like social chit-chat between several people at a cocktail party, the conversation rarely goes into very personal or extremely serious, global topics.

Secondly, informed by conversation analysis [15], Koskinen et al. stress that individual messages are *situated* and understandable only in the local context of preceding and subsequent messages [9: 32]. In addition, they suggest that strategic design should be informed by taken-for-granted patterns of everyday activities [9: 97-104].

Studies above stress the importance of mundane interactions. Still, they merely make the point, without going very deep into the topic.

2.2 Interaction as a Topic of Analysis

All of the studies above draw from more than one of the three orientations. Similarly, In this paper, as I analyze social exchanges, MMS messages as turn-by-turn constructions, I have labeled some messages as announcements and teases. I also agree that they are *age-old mundane practices*. Still, I am not content with categorization or abstractions, but wish to show what it is in the messages that make e.g. a tease for the participants.

In their paper on *The Everyday World as a Phenomenon*, Zimmerman and Pollner make the distinction between topic and a resource in sociological analysis [17]. The authors argue that when analyzing an everyday phenomenon, a professional researcher and a lay person may have different methods of inquiry, but they *are mutually oriented to a common factual domain* [17: 81]. They see that most sociological studies, while claiming to analyze the obvious, still neglect interactional procedures people themselves utilize to make sense of the world. Therefore, Zimmerman and Pollner suggest that analysis should explicate lay people's *methods for analyzing, accounting and fact finding, for these produce sociology its field of data* [17: 83].

What Zimmerman and Pollner suggest for sociology, I recommend also to design-oriented user research. In sum, this paper aims at recognizing interaction as a legitimate topic of research, and to underline its importance in relation to design of interactive products that support ordinary social activities.

3. Data and methods

The MMS messages discussed in this paper are extracted from an MMS pilot study by the Finnish mobile phone operator Radiolinja (hereafter operator) in 2002. The MMS pilot was carried out in summer 2002, just before the launch of the actual service.

The pilot users were recruited by the customer service of the operator. At this point they were informed that we would be viewing and analyzing their messages. The users in each group knew each other before the study.

For the study, all users were given a mobile phone equipped with camera and ability to send and receive MMS messages for free. Amongst the test users 3 user groups, total of 25 users, were selected for a more detailed qualitative study. In co-operation with the operator, we collected all MMS messages of the test groups. The length of the pilot study was 27-37 days, starting from the day the user picked up the phone from the operator. During the pilot study, the 25 users sent 4159 MMS messages.

Informed by previous studies on mobile imaging [9], one of the key questions issued in the MMS pilot study was interaction. By interaction we mean the very concrete ways through which users, in their messages, make visible their orientation to the previous and subsequent messages. For example, a message can sometimes be identified as a reply to some previous message. Similarly, a message can contain an explicit question, continue the current topic, or open a new topic.

As I will show, some MMS messages are built in ways that invite particular type of replies or orientations from the recipients. Still, people do not blindly follow the conventions suggested by the earlier messages. Instead, the commonsense understanding of social structures they draw from, are a resource that can be utilized from an alternative standpoint. This means that while conventions make it easy to maintain a conversation within MMS, the existence of these conventions is recognized, and can be challenged by the participants. As a feature of this social chit-chat, reflections on the behavior of the participants are not problematic, but are performed most routinely.

4. Teasing in MMS messaging

As can be expected, some mundane, existing patterns of interaction and social control will relocate in new technological environments. In this paper I will focus on one particular type of MMS message sequences, teases.
Paul Drew's paper on receipts to teases [3], drawing from conversation analysis [15], takes a detailed look at the *sequential environment in which teasing occurs* [3: 219]. According to Drew, teasing can be a form of social control. This control can take place when someone has been e.g. complaining or bragging, that is, when something has been performed in an overdone fashion. [3: 219]

As a result of a tease, some deviant identities or actions are being projected onto the person being teased [3]. Typically this is done jokingly, that is, though teases are a form of social control and can also be rude, hostility *per se* is not the primary motive behind teases.

In line with the above, the examples below show how teasing in MMS is rooted in the local history of messaging. In order to tease, one has to have something to tease about.

4.1 The Examples

In the following examples the names of the individuals have been changed to protect their privacy.

The first example is an MMS message from Thomas, reporting his life to the whole user group.

Example 1
From Thomas to all: Tuesday 16:42 (+ 0:00 h)

It took 15 years ! But good things come to those who wait.

With the message Thomas informs the others that he and his girlfriend got engaged. He does not announce this directly. Instead, the photo that shows two hands with golden rings, combined with the text about 15 years of waiting, make the announcement understandable for those who know Thomas and his family.

Some hours after the announcement, two replies followed.

Example 2
From Pasi to Thomas: Tuesday 21:03 (+ 4:21 h)
Congratulations!

Example 3
From Jarkko to Thomas: Tuesday 21:27 (+ 4:45 h)

Congratulations! Jarkko, Leo and Topi

Announcements of important family events, especially milestones such as marriages, babies born, graduations and funerals effectively call for replies. Not just any kind of reply will do, appropriate replies must be in line with the announcement; joyful events call for congratulations and tragic events invite another kind of orientation.

The first messages of these pairs set a preference against which subsequent messages can, but need not, orient to. The reply from Jani (below), one day after the announcement, draws from the visual material of the original to make a teasing comment upon rings and engagements.

Example 4
From Jani to Thomas: Wednesday 17:12 (+ 24:30 h)
Screw your ring. Nobody snatches me, except miss universe.

Just like Examples 2 and 3, Jani's message orients to the first message. Instead of empathizing with the joyful announcement, the message exhibits rings, engagements and the like as snatching when involving women lesser than the winner of the Miss Universe title.

In Example 4, the original announcement is a resource for tease as Jani recycles its visual material in his message. Hands with engagement rings are challenged with a hand without any. Similarly, following Jani's tease, the same material, hands and rings, are processed once again as Thomas replies.

Example 5
From Thomas to Jani: Wednesday 19:25 (+ 26:43 h)

Well screw you! Just think that I've got more mornings with my woman than you with your both hands!
Hah hah heh hee

In Example 5, Thomas turns the shared point of attention from rings to hands. The change of course is not random but is performed in order to pay back Jani's tease.

Thomas undermines the likelihood that Jani, or bachelors in general, can have high hopes as regards to Miss Universe. He does this by comparing the number mornings he has spent with his woman to those of Jani's with his hands. Coupling hands with women in this context implies that they are functionally analogous, that is, what Thomas does with his woman, Jani will suffice to do with his hands.

Thomas closes his reply with laughter tokens “Hah hah heh hee”, thus exhibiting that he identifies his message as a tease. Furthermore, the laughter prompts the tease as non-serious and jocular and partly because of that, somewhat final. As a concluding, humorous remark the message downplays the need to continue the discussion in this style.

5. Discussion

In this paper I have shown how mundane patterns of interaction take place in the new technological environment. My analysis has shown how announcements, congratulations and teases, from face-to-face contacts are transferable into interactions with visual MMS messages. In the concluding part of this paper I will discuss the other side of the coin: with MMS, what will change?

The first generation of Multimedia Messaging Services, as they are currently launched in Europe, are not radical. An MMS message today is fundamentally just a text message enchanced with the possibility to add images and audio. MMS draws from SMS for a good reason: images are hoped to boost the already flourishing business around mobile human-human communication.

5.1 Images Are Interactive

Though we have competencies with regards to reading images [10], their meanings are not fixed but can be taken as being under negotiation [11]. As described above, what is implied or expressed with images of hands and rings in the course of an on-going conversation, is subject to change. It would not make sense therefore to analyze the images apart from the context they are used in. Instead of just showing things, images can be used to *build an argument* that is grounded on what has been said or shown previously while projecting particular types of orientations or replying messages from the recipients.

5.2 To Show Is to Report and Tell

Comparing examples above to text messages shows another potential in MMS. With combinations of images and text, users can say things that are beyond text. It is not only that users sometimes need images to explicitly show what an item looks like. Perhaps more importantly, with images more things can be left implicit for further processing by the recipients [9: 51-52]. For the receivers of the message in Example 1, a great deal of the experience is that she/he is to fill in the gaps with what is, for the members of the group, known about the people whose hands are in the photo.

With images we can start topics that are accessible for a specific group only. In addition, images open up the whole spectrum of social traditions, practices and conventions that are reportable and tellable, and even more so in images, for all competent members of the society (e.g. rings in Example 1).

5.3 Images as Co-Present Objects

In MMS conversation, at the side of the text, images can but need not be the focal point of attention. In the messages, images can be just helpfully co-present while the text sets the meaning (see Examples 2 and 3).

The importance of text over image and vice versa can change during the course of the interaction. In Example 1, the image was a building block for an implicit announcement about the engagement. At that moment, the point of attention was not the hands and rings as such but, as shown by replying messages in Examples 2 and 3, the engagement that had happened earlier. Still, to better make a humorously disagreeing comment, Example 4 returns to the visual origins of Example 1, hands, underscoring a specific detail of the image, the absence of a ring.

5.4 Images Help to Maintain Conversation

While in real-time conversation we are accountable for our participation at that very moment, with asynchronous forms of communication, such as e-mails or text messages, time stops between the messages. As result, our reply may stay on hold until it is no longer necessary.

Even though images in MMS are bound to the local history of interaction, they also have an independent quality that can overcome time. The teasing dialogue above *was possible only because of the images*. Between Examples 1 and 4, Jani had sent three messages to the whole group on another topic. Despite this, and the fact that the first message was sent more than 24 hours earlier, the image in Example 4 immediately tells Thomas what the comment is about.

5.5 Images Are a Natural Interface

It is apparent that MMS supports many more forms of natural interaction and does so better than SMS. Images are easy, they are a natural interface. Just like in Example 3 where the smile conveys the happy feelings of the sender, everybody knows how to act in a photo. Still, images are not used as *videophone,* showing talking heads. More often, the conversation is about what is in the images.

Images are fast to produce. Images can be shot in a snapshot manner and even more explicit commentary is easy to construct with the help of images (see examples above). Similarly images can, at will, be consumed very quickly.

5.6 Images Support Mundane Interpersonal Activities

Images are an open interface. Interpersonal communication with images and text is not bound to predefined procedures or specific content, or contexts of use. Just like text, images allow people to organize their own activities and, together with other people, find usefulness for this technology.

In case of MMS, supporting the social aspects of use is the key to success. For social use, future systems for mobile multimedia messaging do not need to *understand* what the conversation is about. The richness of MMS messages by the users implies that proactiveness of this kind would most certainly fail. Instead, our efforts should be targeted at *designing for interaction* through which users themselves make sense of their own activity.

As shown by the teasing messages above, the motives to use a product or a service grow from mundane interpersonal interactions as people invite each other in – in ways that are *ad hoc* and unpredictable yet retrospectively understandable to us all.

6. Acknowledgments

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ARTICLE #4

TOWARDS SOCIALLY AWARE PERVASIVE COMPUTING: A Turntaking Approach

Esko Kurvinen and Antti Oulasvirta
Helsinki Institute for Information Technology

Abstract

Social context is an important yet an underresearched area in context-sensitive computing. This paper adopts a framework from social sciences that views social context as a sequence of turns taken between participants. The approach is illustrated and evaluated through three empirical cases. The results show that social context is not a static and passive surrounding of a device, but dynamic and constructed by people. Challenges and restrictions for modeling social context through turntaking are identified.

1. Introduction

Mark Weiser envisioned future computing "weaved into the fabric of everyday life" [17], a philosophy that ran counter to the then prominent workstation-based human-computer interaction. One presumption behind the vision is sensitivity to the *social* context of interaction. Without social sensitivity, provided services may be needless, proactive actions inappropriately timed, interaction styles improper – eventually causing social weight [16] and disturbing social lives. Social aspects of context are generally agreed to be important, but modeling them has been considered difficult if not impossible (e.g., [5]). This paper proposes and evaluates the suitability of a social scientific framework for modeling social contexts. It is a part of a wider attempt to integrate various empirical methods into the development of context-aware computing [11].

©2004 IEEE. Reprinted with permission, from Kurvinen, E. and A. Oulasvirta (2004). Towards socially aware pervasive computing: A turntaking approach. In *the Second IEEE International Conference on Pervasive Computing and Communications (PerCom'04)*, pp. 346–350.

2. Previous Research and Our Approach

Most previous research has utilized rather straightforward indicators of social context (e.g., see [1]). Presence of people, audio level in a room, activity of communication channels, and calendar entries [10], for example, have been taken to indicate meetings, availability for chat, interruptability, and the like. This approach pays attention only to *static context* factors, variables that can be directly measured and determined at any moment in time (e.g., time and location) [12, 15]. Most often, a causal relationship between sensor data and explicit description of context is presumed. The approach can also be characterized as bottom-up; that is, the immediately available sensor data alone determines the context interpretation (see e.g., [7]). Context, though a relatively new concept in computer science (e.g., [2]), has been studied in social sciences for decades [3, 4, 13]. Specifically, the turntaking approach investigated here distinguishes itself from the static factors approach in five respects:

1. Specificity. Context is local, situational, specific, and coupled with the activity where it emerges. Thus, there can be no general definition of context. Similar remarks have been made recently by researchers who approve that context depends on the particular application (see Personal and Ubiquitous Computing Vol. 5, 1).
2. Constructivism. The focus is much more on what people do than their static surroundings. People are not just passive parts of their environment but they actually create context in their action. These actions are here referred to as turns. As will be discussed later, turns often consist of speech, but may also include various kinds of non-verbal acts.
3. Dynamism. Context is continuously under construction. It is interpreted, re-interpreted, created and re-created in the turns people take [13, 14]. Temporal dynamics of turns make an important addition to static factors: For example, distance between two persons (a static factor) in a cafeteria is not enough to infer whether they are engaged together in an activity. If this is combined with information about bodily orientations, speech distribution, and, importantly, their temporal overlappings, the social context can be better guessed.
4. Shared preunderstanding. Shared preunderstanding among participants is necessary to take part in a social situation. Participation in a way that makes sense for the other participants

and constitutes being a part of that social group. Consequently, deviations from the expected patterns cause disruption to the social engagement.

5. Pluralism. A situation can give raise to multiple contexts on conceptually incomparable levels. For example, when talking to a colleague, one may orient to her profession, gender [14], or hat (that may be inappropriate for the situation), and react accordingly. Also, contexts are not always exclusive, but can apply simultaneously.

3. Turntaking in Group Invitations

In the following, three cases of group invitations are presented, ranging from a relatively simple case to one of the most complex cases in our data. The cases are chosen to illustrate how the participants of the invitation actively transform their social and bodily contexts in turns. In the invitations described here, a person or a group of people (the *inviters*) ask another person or a group of people (the *invitees*) to join them to a meeting at some time and place in the near future. Our interest is not so much in conversational dialogues [3] or direct and explicit invitations such as invitations to events like parties, weddings, or meetings at a workplace. Instead, the focus is on invitations that are embedded in action and remain partly or completely implicit and yet recipients are able to recognize them as invitations and act accordingly. These kinds of invitations may be closer to the capabilities of current sensor technologies than those requiring a fine-grained analysis of speech.

The data were collected in a user-centered product concept design project for ubiquitous computing (see [12, 15]). The data presented here are extracted from observations conducted during fall 2001 in Helsinki.

The cases are not without practical significance for context-sensitive computing. Several novel applications could be implemented presuming that one could successfully recognize situations where a user is inviting others or being invited. Resources needed for rendezvousing could be proactively prepared (e.g., checking if the intended meeting place is reserved). In the case of important not-to-be-forgotten invitations, an automatic digital reminder of the occasion could be sent. In addition to services like these, adaptation of the user interface could take place. Input and output modalities could be selected taking into consideration those resources that are reserved for turntaking, and incoming messages could be timed to minimize interruption during the critical phases of social interaction.

3.1. Case 1: Invitation to Café

The amateur theater group (four 22–24 year old men and women) spends a lot of time together in a café called Kafka, located in a lobby of the theater sponsoring their play (in the city center). The café has become an important meeting place for the group it is visited alone, in pairs, or together with a larger group, 2–5 times per week. Even if just passing by, group members often take few extra steps to drop in to see if their friends are there.

When one of the group members wishes to meet another at Kafka, he/she sends an SMS invitation containing plainly "Kafka". This is usually enough; with the condensed message, the plan of going to Kafka in the next hours or so is made visible. The message "Kafka" is not an explicitly agreed codeword but has streamlined into an invitation as a result of repeated practices of the group. Because of SMS, there is no need to fix a time beforehand. As it often happens, invitees just drop in later because they know that the inviters are likely to spend few hours at the cafeteria anyway. There is no need to specify a list or number of participants beforehand either. Because the meetings often lack a specific motive, nobody is likely to miss anything important for not showing up. Thus, the meaning of the message, while being narrowed down to an invitation, is capable of raising several alternative responses. Details of the meeting are issues that can be dealt with in the possible replies or conversations via SMS or mobile phone.

To summarize, the inviter takes the initiating turn in creating a context by sending an SMS "Kafka". For the invitee, this marks a change in the inviter's context that could be, but does not has to be, reacted upon. This invitation, consisting of one nodal turn, while often failing to be realized as a meeting, also succeeds in producing group awareness (see also [9]).

3.2. Case 2: Invitation to Sing-and-Play

Case 2 comes from observations of two women working at a playground (hereafter the Park). Every Thursday 9 am, Irene and Jane arrange a sing-and-play at the Park for small children and their parents. Although schedules are posted for visitors to read at the front door of the main building, parents present at the Park are invited individually, at the scheduled time, to join the play by one of the women (Jane) walking through the park and making casual marks to people.

Here, the inviter's turns take the form of appearance of the inviter at

expected the time and place of sing-and-play, and casual remarks to people. The invitation is embedded in the small details of Jane's interactions with the potential participants for the play. Jane greets some, but not all people in the Park. While doing so, she makes sure that those who have participated before will notice that she has arrived and the play is about to begin. The selection of the walking route, greetings, and casual remarks are not just compliments but they also function as invitations to participate.

Similar to Case 1, the invitation to sing-and-play needs not to be presented as direct verbal questions or requests. Even though the sing-and-play is a scheduled event, it requires further specification of time and place, notifications to the potential participants, and gathering of those who eventually attend. That there is a sing-and-play every Thursday morning and that there is a poster on the wall, build preconceptions that help invitees to reason Jane's intentions from her behavior. Furthermore, invitations are left implicit not only because the shared preconceptions make it possible, but also because it gives the invited people the possibility to not to participate without having to give an excuse.

3.3. Case 3: Invitation to Lunch

Our third example comes from observations conducted at an editorial office of a weekly IT-magazine located in the city center (hereafter *the Office*). The Office is a somewhat typical open space where each worker has his/her own table either arranged next to someone else's or separated by low cubicle walls.

The journalists of the Office often have lunch in small groups. Though some journalists typically have lunch together, the composition of the overall group may vary from day to day. The activity of organizing a lunch requires some negotiation before who goes to lunch with whom, when, where and who may also join, is agreed upon. The invitation was usually achieved in the following order:

1. Prior to the invitation to a larger group, two or more people have already discussed on what to eat and where. This is carried out either in face-to-face conversations or via email. A rough estimate of time, "noonish" or "after I've checked email" for example, has been agreed upon at this time.
2. When the agreed time for lunch is due, first participants start to gather next to the coat rack close by the lifts. Typically, they put their coats on unhurriedly, just hanging around next to the lift for a while. Only rarely they shout out loud or ask someone directly to join for lunch. Rather, the invitation to attend lunch is presented by making one's loitering next to the exit visible to others.
3. At this point, when the invitation is on, others in the office can, and often did, self-invite themselves and join the group of lunch-goers. Sometimes the co-workers project a receipt of invitation ("Are we going now?"), a request of verification that the invitation is understood correctly ("Going for lunch?") or a request for more information ("Kebab- place?"). If an orientation to an invitation is made clear, either an acceptance (joining the group) or negative reply, often in a form of an excuse, is presented ("I have to finish this article first").

Here, a group of people invite others to lunch by loitering with their coats on in front of an elevator. All of the actions presented above, while not always containing an explicit formulation in respect to the invitation, are parts of the turn-by-turn production of the local context of going-for-lunch embedded in a larger context, the work setting of the Office. The participants know that at a given time, other journalist may have work in a phase not allowing for interruptions. They therefore have to balance between the convenience of having lunch together and possible disturbance caused by the invitation. That is why the invitation has evolved into an unobtrusive and embedded, yet easily recognizable, routine of hanging about at the exit with overcoats on before stepping out of the Office.

In contrast to Case 2, there was no explicit prior agreement behind the invitation to lunch. Still, going for lunch, as a result of it being a daily routine, is easily recognized by the participants and offers similar resources for interpreting people's behavior in the Office. Whereas in Cases 1 and 2 SMS messages and greetings were directed at specific individuals, the implicit invitation here does not have specific recipients at all. Moreover, in contrast to the first two examples, the invitation was achieved in co-operation with others. A single person standing next to the exit does not make an invitation. The other journalists, still sitting at their desks, while recognizing that an invitation has been presented, may select themselves as being invited, even when the invitation did not specify any recipients.

4. Discussion

Through the three cases, it has been shown that the dynamic and constructive aspects are important in social contexts, even in seemingly simple activities such as invitations. The analysis highlights that static factors (e.g., time) of context are only a starting point in which people define what is relevant for them at a given time. Social contexts are not based on explicit agreements; rather, they are interactionally achieved turn-by-turn.

The next step is, of course, to test the turntaking approach in a practical application. The challenge there is that the proposed concepts must prove operationalizable. Anticipating this challenge, the paper is concluded by discussing challenges to using turntaking in modeling social situations:

1. *Recognizing static factors*. As argued, static factors are starting points for action. As reviewed in Section 2, many useful techniques have been developed for the purpose of recognizing static factors. However, some static factors require much more sophisticated methods. For example, the time and place of sing-and-play (Case 2) is announced on a paper schedule posted on a wall in the Park. It is likely these kinds of low-fidelity, hard to interpret (for computers) yet effective aids (for humans) will never disappear from public spaces.
2. *Recognizing turns*. Turns, the "atoms" of interaction, seem to be by and large detectable by present- day technologies:

- Speech. A great deal of interactions in our cases were organized around speech (Cases 2 & 3). Whereas recognition of the content of speech may not be possible for a while, it might be possible to recognize where and when it occurs and how it is distributed among participants ([8] and Case 3). For example, people whose talk overlap only briefly are likely to engage in a conversation [13].
- Movement. Recognizing not only person's presence in a setting, but also the direction of movement, could be used as an index of turn, as illustrated in Case 2 where the route of the inviter through the Park indicated an invitation.
- Bodily orientations and gaze. In human-to-human conduct, bodily orientations and eye-gaze play an important role. The direction of gaze and posture help to interpret the focus of attention and turns. In Case 3, for example, people who oriented to the invitation by looking at the inviters had to come up with excuses why not to join them.
- Messaging. In contrast to technological development that generally moves toward contents of higher fidelity, the invitation to the café case (Case 1) shows how short and uninformative contents ("Kafka") may be meaningful in the context of locally developed and group-specific practices [6].

3. *Recognizing sequences of turns*. Turntaking is orderly and adheres to an implicitly agreed sequential structure. For example , the three-step description of invitation to lunch (Case 3) would do as a loose sequence description. Whereas modeling sequences of turns might not be impossible for present-day inference technologies such as dynamic Bayesian networks, a more difficult challenge is posed by the fact that there may be many possible activities that match one type of turn sequence and vice versa. In other words, one type of turn sequence can signify different social activities. Recognizing sequences thus requires rich data and custom-tailored interpretation machinery.
4. *Interpreting meanings of turns*. Characteristic to our cases is that invitations were often presented trusting that the features of intertextual elements, existing collaborate practices and bodily orientations, "fill in" and make the invitation understandable. From this perspective, the problem lies not so much in recognizing individual turns but at what time a turn becomes meaningful. For example, the shape and timing of Jane's walking route (Case 2) and her casual remarks to parents are interpreted as invitations by the participants. Making such deep-going interpretations from sensor data is inherently difficult for computers that are denied of the social learning process of humans. It seems unlikely that a context-sensitive system could learn this purely from recordings of cooccurrences of events (e.g., people in the same location/ time). Perhaps the best that a computer can learn, without hard-wiring the meanings of turns, is recurrent patterns of interaction, which has only limited value in interpreting turns. How meanings could be effectively preprogrammed into the system requires further research.

Furthermore, pluralism poses a problem to bottom-up approaches (see Section 2) to turn recognition. Inferring the meaning of a turn simply from sensor data is difficult, because a turn can be part of many turntaking activities. In addressing this, one needs top-down interpretation where sensor data on t1 gives rise to the direction, selection, and interpretation of data on t2 and so on.

5. *Flexibility for individual differences.* A related challenge is that the model must be general enough but still leave room for idiosyncrasies inherent in all behavior. Across individuals, turns may be left out from the sequence or take qualitatively different forms. Furthermore, as shown in Case 2, turntaking behavior in a group is streamlined over time. For a modeler, solving this challenge calls for empirically investigating the range of possible behavioral patterns.
6. *Sensor selection.* In interpreting turns of others, people use rich context data. Turns may take different forms, each of which may require a different sensor (e.g., speech, telephone, gestures, posture). For obvious cost-efficiency reasons, however, not all sensors can be included in a single device. The problem is that the qualitative data gathered in user studies does not support selecting the sensor with the best predictive quality (quantitative attribute). In order to understand how well sensors can predict events, qualitative knowledge should be supplemented by quantitative data on how frequently different types of turn sequences occur. These estimations can be obtained, for example, from log analyses, or codings of videotaped activities.
7. *Selecting a clear application domain.* The intricate complexity of social interaction does not allow for a general context recognition apparatus. In situations where such system would be 99% sure of what we are engaged in, this information would probably be already self-evident and therefore useless. In less predictable situations there would be a risk that the system only annoyed us with inappropriate interpretations. Therefore, we suggest focusing on applications that are narrow enough for the related turntaking activity to be wellunderstood yet useful for the end users. This calls for defining a clear purpose, activity, and users.

To conclude, the turntaking approach seems promising. It entails concrete enough concepts to look at social contexts. It emphasizes that there is more to context than location or time and calls attention for what people actively do. Here, the approach concurs with the emerging Attentive User Interfaces approach (see Communications of the ACM Vol. 63, Issue 3) that focuses on what the user attends to instead of her passive surroundings. Our study revealed that social context is specific and embedded in activity, constructed and dynamically upheld in turns, based on shared implicit and explicit preunderstanding, pluralistic, and expressed through multiple partially redundant channels. Modeling turntaking requires integrating qualitative and quantitative user study methods and implementing a top-down context-recognition apparatus with many sensors, hard-wired expert knowledge, and flexibility for idiosyncracies. Social sensitivity is possible in well-defined, well-studied, and well-modeled domains.

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ARTICLE #5

ARE YOU ALIVE? Sensor Data as a Resource for Social Interaction

Esko Kurvinen, Helsinki Institute for Information Technology
Mia Lähteenmäki, Nokia Research Center
Antti Salovaara, Helsinki Institute for Information Technology
Fabiola Lopez, Suunto

Abstract

This paper presents findings from the field test of a prototype device that collects heart-rate sensor data and displays it for users. The prototype was tested on a football team, including teenage players, their parents and coaches. The findings include notes on user expectations related to the technology and detailed analyses of the social interactions that took place during the test. The paper concludes with design implications relating to this application, but also poses challenges for context-aware computing and machine intelligence in general.

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1. Introduction

The study discussed in this paper is part of MobiLife, an IST project investigating mobile applications and services supporting families in their daily lives. This paper discusses the user evaluation of an early stage prototype consisting of heart rate sensor belts, a system that collects the information from the belts and a mobile application displaying the information for the users. During the test, eleven teenage association football players wore the belts, while their parents and coaches at the ground used the application.

Three types of research interest motivated the test.

First, we wanted to test hardware that is already on the market in an unusual context. Heart rate monitors are currently targeted at individual athletes who want to enhance their training. By contrast, the usefulness of the technology in the context of team sport and sharing of sensor data are poorly explored.

Second, our technical research interests relate to utilization of sensor information in the area of context-aware computing. The idea is that computer systems collect information about the environment, situation and activities of the user. This information is then abstracted into so-called high-level contextual information, telling the user and/or applications and services what the situation is and how people can be assumed to behave in this context. This approach is not new, but is in line with mainstream context-aware computing (see, e.g., Dey et al. 2001).

Third, from the end-user point of view, we wanted to explore the idea of collecting, displaying, and sharing personal sensor data among a group of users, which is the focus of this paper. During our previous user research cycle, scenario evaluation (Aftelak et al. 2005; Galli 2005; Kurvinen 2005), we learned that the interviewees were very reserved and suspicious about concepts that involved wearing sensors and allowed other people to see the data. During this second round of user research, therefore, we wanted to give the users a hands-on feeling of what it would be like to monitor the wellness and performance related data of a family member, discuss it with the other participants, and so on. While the intelligent technology that makes sense of sensor data is not available yet, we wanted to see how people themselves make sense of and use that information, and what sort of design implications this raises.

2. Data and Methods

The Wellness-Aware Multimodal Gaming System, the topic of our study, was derived from a project-internal scenario in which a family spends its free time together and in which parents want to participate and support their child in association football (soccer) as a hobby. (For description of the process, see Aftelak et al. 2005; Galli 2005; Kurvinen 2005) The prototype study was not strictly about discovered user needs, but was an attempt to explore and collect ideas about possible sensor data usage.

The Wellness-Aware Multimodal Gaming System uses sensors to collect wellness data and allows information sharing with both mobile and non-mobile users. The domain is not restricted simply to football or even sport. It is envisioned that collecting sensor data could be beneficial in all sorts of applications used in everyday activities.

The prototype application that was implemented concentrated on the original scenario activity, a football match attended by the players' parents. To keep it simple and to avoid technical problems, we only conducted heart rate monitoring. From the outset it was clear that the next version of the system would also plug into other types of sensor information. The prototype was user-tested at a football practice session, at which the team, coaches, and family members were present. In the prototype evaluation setting, the players wore heart rate belts and spectators standing beside the field (now restricted only to parents and coaches) had a mobile device from which they were able to view the sensor data. On site we had six mobile phones with the installed application.

In addition to the mobile phone UI, one laptop was provided to allow viewing of heart rate data graphs of several people simultaneously on a big screen. The system is described in Figure 1 below.

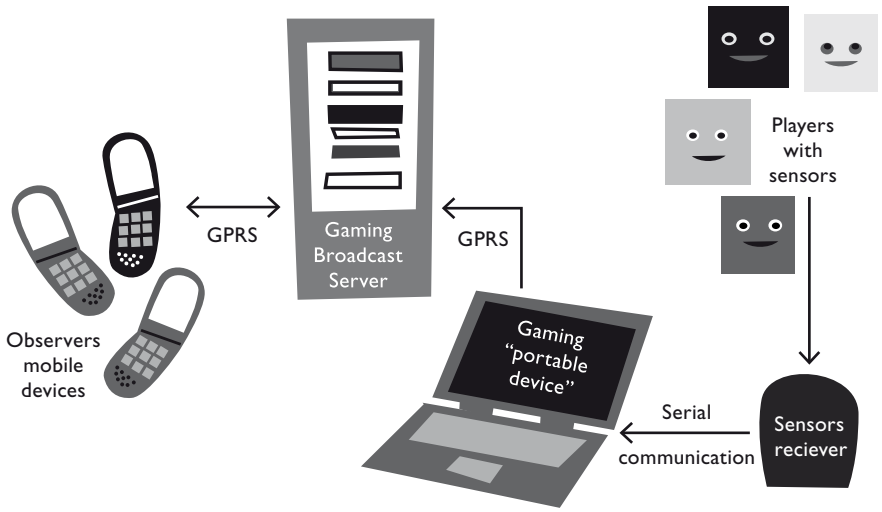

Figure 1. System diagram

The mobile application worked in the following way. Family members and coaches can select the game to follow on the application welcome window in their mobile phones. They then choose the players they would like to monitor from the team member list, and the application shows a table listing all the players selected. The table contains the player's name, heart rate value, speed (not measured in the prototype for now) and a smiley. A smiley (emoticon) describes the current status of the person compared to his personal minimum and maximum heart rate. The order of players on the grid changes as the heart rates change, so that the slowest heart rate goes up and the fastest down.

The data was received in real time. The application also made it possible to watch history data of last three minutes for an individual player in graph format.

No access rights were implemented, meaning that the sensor data from all players was accessible to everyone. The duration of the football practice (and the test) was roughly 1.5 hours.

We had three types of user on site:

- Players. Eleven teenage boys at the age of 14-15 wearing the heart rate belt sensors. The total number of players at the practice was 25-30.
- Parents and family members of the players. As some arrived late and some left earlier, the number of parents present varied from 8 to 12.
- Coaches. During the session, the head coach and the assistant coach were usually on the field with the boys. The third coach, also the team manager, was using the system together with the parents next to the field. The head coach and the team manager were also interviewed immediately after the test session.

In addition to the users, the test involved two types of facilitator:

- Three user researchers equipped with video cameras coordinated the test, observed the use of the prototype, and interviewed and talked with the users.
- One technical facilitator was present to set up the system and handle technical problems.

Our analysis is based on a combination of semi-structured questions and ethnographic observations, including field notes as well as analysis of transcribed videotapes. When planning the study, we listed social acceptability, the general usefulness of the system and ideas about the types of sensor information that would be considered useful as things we wanted to address. In addition, we wanted to study communication beside the field and sensor data presentation issues.

We thus asked a lot of questions before the test session and while observing the use of the system. It soon appeared that we should distinguish between the expectations that users have, and actual the use of the system. This was not only because interviewing and observation generally give different types of findings, but also because these findings were partially contradictory.

The first two empirical sections below are about user expectations, i.e., how they perceived the system in the discussions apart from its actual use. We proceed from these general notions towards more detailed analysis of interactions that took place during the test.

3. Results

Formal Use and Usefulness of the Heart Rate Information. When the application idea was first introduced to the team leader and the coaches, they were able to identify its potential usefulness as a training tool and a way to persuade parents to motivate their children to attend practice. They suggested that the parents could see with their own eyes from the system if their children were not as fit as other children because of not practicing enough.

One potential conflict between parents and coaches is the match time their children get during games and tournaments. Typically, parents want their children to get more playing time and they sometimes contact the coaches to ensure this. Coaches, on the other hand, do not want to give match time to players who are not practicing frequently and/or are not in good shape. A system visualizing training intensity and progress could easily provide information for such negotiations between coaches, parents and players.

One mother pointed out that parents might not have enough background information to interpret the data properly. She considered this mainly as a tool for the coaches to use for the benefit of the team. Indeed, the coaches were able to describe detailed multiple purposes for the technology, for example:

- Help in building players with good basic physical condition.
- Get to know whether players practice efficiently in their own time.
- To ensure that everyone practices at their own optimum level.
- Split players into groups according to their physical condition so that practices could be designed to be the most efficient for each group.
- Help parents to understand decisions made by the coaches and to help them in motivating their children to attend training.

When asked, the parents mentioned the coaches as primary users to benefit from the system, but they in fact used the system very intensively during the practice regardless of the fact that the users knew that, because of technical problems such as lags and breaks in connectivity, the information was partially flawed and incomplete.

Social Acceptability. As mentioned above, during our preceding scenario work, the families interviewed in Italy and Finland were very reserved and suspicious about sensor technology and machine-made inferences. First, at a general level, they considered this as *big brother* technology. Second, it was difficult for them to foresee the usefulness of the technology or the practical value it could offer. Third, there was doubt whether such systems could ever deal with the complexity of daily life. The participants were concerned that the technology would only interfere and cause more problems than it solved. (Aftelak et al. 2005; Galli 2005; Kurvinen 2005).

In contrast to all this, no one questioned the social acceptability of the system during the test, or the fact that all the measurements were shown to all the parents and coaches without any constraints such as access rights. It appeared that there was no lack of volunteers to wear the belts either. This may be because the players were already used to being ranked and compared all the time. Sensor information was seen as useful insofar as it could help in achieving personal and team related goals. The players also knew that the information was shared only during this event, and only amongst those present. Although they did not necessarily know everyone, they had an idea of the size of the group and its limits.

Parents had no doubts about viewing the data from all the children either, even the children they did not know; it seemed to even create a sense of togetherness that might have not been possible if parents had only seen their own children's measurements. The system was seen to enable better comparison between the players and thus enable even more straightforward comments and harsher ranking between players. For example, parents said the system could be used to draw conclusions about who is slacking off and who has the right kind of attitude. Despite this, the participants failed to mention any problems that the system might cause.

Mobility and Ad Hoc Grouping. Originally we assumed that people would prefer using the PC instead of the mobile device in order to see a large amount of information at the same time as a graph. This was proved to be wrong in the test. Small devices were essential when moving around beside the field, watching and commenting on the game and the heart-rate readings with the other participants. Having multiple mobile devices present enabled ad hoc grouping

of the participants. There were always several parallel conversations surrounding the devices and the participants were able to move from one conversation to another and adjust the number of people and devices in any one group.

Making Sense of the Heart-rate Data. Understanding the wellness data requires extensive knowledge (see also Example 5 below). For example, the heart-rate measures of two different players are not directly comparable because each body is unique and data should be compared mostly against previous measurements from the same person. This was explicitly mentioned at the beginning of the session.

However, as meaningful physical interpretations of the heart-rate readings were not accessible, the participants had to develop other means to make the data intelligible and useful.

- *First*, although they were advised that values were not to be compared directly, comparisons between players were made throughout the session. For this, data presentation in grid format was most helpful, as it showed the order of the players according to the measured heart rate.
- *Second*, exceptional readings attracted considerable attention. The grid format also made it easy to see which players had the lowest or highest heart rates.
- *Third*, to make sense of the readings, one needs to understand what the person being measured was doing when the measurement was taken. The participants were constantly mapping the abstract values shown on their devices against the activities of the players on the field.
- *Fourth*, the participants followed not only the numbers per se, but the history of individual values. For example, pulse readings that stayed the same for a long time or changed rapidly very often attracted the attention of the users.

A heart-rate reading of an individual player at some random moment is relatively useless and unintelligible. To really make sense of it, one has to know more about the physical condition of the player, the objectives of the particular exercise, and so on. Because this information was largely unavailable, the users actively sought other **points of reference** against which the numbers could be understood, evaluated or appreciated. Thus an individual pulse reading does not suggest some fixed meaning, but stands in relation to other available items. As to what are the most relevant items, we discovered that the users were very flexible. Interestingly, this also made corrupted information more accessible to them.

During the test there were breaks in the wireless connections and other technical problems, which meant that the heart-rate readings were not always up-to-date. With aid of the reference points, the participants became aware of the deficiencies in the data and sometimes were even able to compensate for its poor quality. This was done, for example, by filling in the missing pieces by looking at the pulse readings of the other players doing similar things.

The users were making sense of the multiple heart-rate readings, keeping track of the changes, and looking at the activities on the field while also accounting for the deficiencies of the system. It would be really difficult to do this all *alone*. Thus, despite the immature representation format and poor data quality, and partially because of this, the participants sought help from each other as they were trying to make sense of the data. On the other hand, they were not only reasoning about the sensor data, but also cannibalizing it for their local communicative purposes. In the sections that follow, this general notion is elaborated by more detailed analysis of the interactions.

Getting to Know Everyone. From the point of view of the parents, a straightforward positive effect of the system was that it helped them to get to know each other and their children. It appeared that not everyone associated with the team knew each other beforehand, and this happened quite naturally with the aid of the devices.

Example 1[1].

```
01  A:  {looking at the device} I wonder who Lauri T is?
02  B:  Tikka
03      (---)
04  A:  what does he look like?
04  B:  who?
05  A:  Lauri T.
06  B:  Lauri Tikk[a . the goalkeeper Lauri
07  A:            [yea
08  B:  oh him is that Lauri?
```

In the example above, A sees the name of the player on her mobile device. Not knowing who Lauri T.[2] is, she could not associate the heart-rate information with the appropriate player. Asking help on this also provided her with more information about the player. It appeared that the system provided legitimate grounds for asking for more information about people one did not know very well.

Forming Opinions about Numbers. In the following example, the players are just starting a short break. One of them, Tomi, had had considerably lower readings than the others, which attracted the attention of the participants.

1. For transcription conventions, see Appendix.
2. The names of the participants have been changed.

```
Example 2
(C1 & C2: coaches, F: female participant, M: male participant)
01  C1:  STRETCH (.) AND THEN JOG TO DRINK SOME WATER
02  C2:  look at Tomi- Tomi jumped to seventy-six eighty-one
03  M:   yea he heard go and get a drink
04       {laughing together}
05  C2:  now its one hundred and twenty
06       {laughing together}
07  F:   he has to do some work now
08  C2:  when he was running it was £seventy-eight£
```

Although Tomi's reading was exceptionally low, this alone was not enough to initiate conversation. The participants associated pulse readings with activities on the field to make a point or to form an opinion. In addition, changes and trajectories in both pulse readings (lines 2, 5, 8) and activities (lines 3, 7, 8) were taken into account.

Viewing individual values in relation to other available items enabled the users not only to make sense of the values, but also to make sense and communicate different aspects of the activities on and beside the field. For example, moral judgments about the activities of the players could be constructed. The two examples below illustrate this. In the first, a female participant makes comments to her son about the measurements she had seen on the device.

```
Example 3
(P: player, F: female participant, O: other parents)
01 P:  {walks through the group of parents}
02 F:  @this is really terrible you are in such bad shape-this
03     does not- we don't know what to do with you now@
04 O:  {laughing together}
05 F:  we have to use the six free days this month to practice
```

F comments on the heart-rate readings to her son in an animated tone (lines 2-3), framing the comment as non-serious. This is also how it is received by the other parents (line 4). Similar joking or teasing appears in the example below. A few moments after Example 2, when all the players were gathered beside the field for a small break, the coach looked for Tomi.

```
Example 4
01  C:  TOMI (2.0) TOMI (3.0) where is Tomi?
02  M:  no answer because its fiftyseven
03  C:  {turns to Tomi}
04      >no I was just< fiftyseven- like I just checked
05      that are you alive?
06      (1.0)
07  F:  £Tomi has fiftyseven£
08  O:  {laughing together}
09  C:  well now it's sixtysix
```


These two examples have some common features. The assessments are shown directly to the player that the numbers concern. The comments do not so much sum up what the numbers mean as serve to stimulate humour, allowing the other party to grasp, comment on or account for whatever showed. Interestingly, the players completely ignored the comments. This means that while the comments were apparently directed at the players, they possibly were not the primary recipients. This was apparent in how the coach made sure that the adults present were listening in Example 4 (shouting in line 1); likewise reception and appreciation displayed by the other parents (Example 3: line 4, Example 4: lines 2 and 8).

In the two examples above, the members of the audience were not so much doing things for or because of the boys with aid of the sensor data, but doing things for the other adults in the audience.

Comparisons Between Members of the Audience. As sensor data serves as a resource for social interaction, it provides not only for comparisons between players, but between members of the audience.

```
Example 5
01  F:  {looking at the screen for >20 sec.}
02  F:  this should include some medical science knowledge so
03      that one could know what sort of values kids this age
04      should have
05  M:  quite low (3.0) now that they are constantly training
06      like- (5.0)
07  F:  yeah, one could compare this to the type of (.) person
08      who is not like [constantly training
09  F:                  [{smiling}
10  M:  {smiling} m↑mm
```

In the example above, the couple is discussing how they should interpret the pulse rates of the boys. The wife (F) is suggesting to her husband (M) that the information could be used for comparing the values of those who are in very good shape (lines 7-8). This can be seen as referring to the wife and husband themselves, as the wife's comment is offered by turning towards her husband and smiling at him. The husband agrees with a hmm with rising intonation (line 10).

Because the physical strength and stamina of men and women are substantially different, it would be very difficult to sell the idea of a system that enables wives and husbands to compare their performance values. A system connected to a third party such as children, however, would support indirect and perhaps more favorable comparisons between all family members. While direct comparisons of parents' performance values might invite serious and unfavorable competition, the performance values of the children could serve as a neutral and playful

reference point against which the parents could also reflect on their own physical well being.

Watching the Game Together. Currently, beside financing the football hobby and providing transportation, there is no natural participatory role for parents at the ground. Interestingly, the prototype system changed the typical practice setting so that the parents were now monitoring the players keenly. It may be that they were talking to each other more than before – or at least they had better means to talk about the game, instead of some other topics.

We can say that, with the aid of the prototype, they were watching the game together. This notion is not as obvious as it may first seem. People standing next to the field may be physically close and following approximately the same events on the field. It is also easy for the participants to assume that their *perspectives are interchangeable* (Coulon 1995, 5), i.e., that their interests and motives as regards to game are pretty much the same. However, they can merely assume this, as there are no actual means to test it. Just being located next to the field does not engage parents in joint activity with the other spectators. The prototype system provided a means of sharing the experience. One such moment is elaborated in Example 6 below.

Example 6
(A,B&C: female parents, D&E: facilitators)

```
01  A:  Aaro has guite a high pulse [. has had
02  B:                              [yes
03  C:  Kalle has onehundredandseventy
04  A:  tough guy ehe[h. tough guy tough pulse
05  C:               [KARI *si:x*
06      (4.0)
07  C:  Kari one hundred and  [seventysix
08  A:                        [there are so much differences
09  A:  {turns towards E}can this for Tomi be true because its
10      like [fiftyfive
11  C:       [fivefive
12  B:       [{turns gaze towards A and E}
13  A:  and it has not been over one hundred I
14      think (1.0) [can it be=
15  C:              [Tomi *is-*
16  D:  =no it can't be true (0.5)
17      i reckon [it's not properly in place
18  A:           [HEY IT JUST[jumped to seventy-one
19  C:           [hey it just jumped
```


In this excerpt, the three users are not looking at each other, except for one brief moment at line 12. Their gazes are focused on the mobile phones displaying the sensor data and on the activities on the field (see Figure 2). However, a close examination of the interactions reveals how the three women are taking each other's perspectives on the activity on the field into account. First, A comments on Aaro's pulse rate (line 1), which is recognized by B in an accepting manner (line 2). Second, C, looking at her device, gives a neutral reading for Kalle (line 3). This is commented on by A: "tough guy", followed by a short laugh and elaboration: "tough guy, tough pulse" (line 4). The laughter is treated as a summing up by B, who raises her voice to take the floor and read the reading for Kari aloud (line 5). However, as A chooses to continue with her elaboration (line 4), C lowers her voice and withdraws (line 5). After a reorienting four-second silence, C announces the reading for Kari (line 7). This is however ignored by A, who is already focusing on Tomi and his exceptionally low reading (lines 9-10). As A asks facilitator E about the reliability of the reading, C ends the sentence together with her (lines 10-11), showing that she also has turned her attention to the same item. B also turns her gaze from her mobile phone and looks at A and E (line 12). Facilitator D starts to explain that the sensor belt may not be properly in place (line 16). This is however interrupted by A, who gets a new, higher reading on her device (line 18). C follows immediately echoing the same phrase: "hey it just jumped" (line 19).

Figure 2. Three women looking at the game side by side

We can extract five specific types of interaction between parents from this example. Assisted by the technology, the parents were not just haphazardly co-present but engaged in interaction with each other:

- First, participants **select some pulse reading** one at a time from their mobile phone display, and **offer it for others to read** on their *own* devices (lines 1, 3, 5, 7, 9).
- Second, the receiving party **informs the others about attention shift** to the suggested item. In the example, this is done by an *agreeing utterance* (line 2), *evaluating comment* (line 4), by *reading* the pulse reading *aloud* (line 11), with a *bodily gesture* (line 12), and *repetition* of the previous utterance (line 19).
- Third, participants **make room for each other** so that items can be suggested. This is shown in C's withdrawal at line 5 and silence at line 6.
- Fourth, the participants try to **make sure that the others hear their offerings**. Increasing the speech volume (lines 5 and 18) and repetition (line 7) serve this purpose.
- Fifth, the participants did not always continue to the next item following co-operative selection of an item, but stop for a moment to **evaluate the pulse reading** in question (lines 1-2, 3-4, 8 and 9-10).

Similar interactional patterns can be seen throughout the data, including the previous examples in this paper.

The examples above illustrate how a fairly simple sensor data presentation interface, supported by verbal interactions, was able to facilitate fairly complex multi-party activity. Being co-present at the same place while being able to interact via talk enabled the users to be aware of what the other users were currently viewing. Furthermore, the users actively sought to orient their own doings to those of the others. Although apparently focusing simply on their own devices, they were in fact *using the system together.* Mediated by the system, they were also engaged, quite literally, in *watching at the game together.* Similar collective uses of mobile phones have been analysed in the activities of rally spectators and teenagers (Salovaara et al. 2006; Weilenmann and Larsson 2001).

4. Design Implications

Our suggestions for the developers range from specific design challenges to general guidelines. Some suggestions are relevant only to the next version of our application, whereas some design potentials are applicable elsewhere.

From Performance Measurements Towards Social Coordination. The sport environment was a successful, although somewhat obvious selection for testing the heart rate sensor technology. During the test, we discovered not only that the context motivates sensor usage, but also that there are positive effects and potential beyond the typical usage of heart rate information. Instead of building a sensor-enabled system for social awareness, interaction and coordination from scratch, it would be strategically wise to proceed in this direction from a context where the technology is already accepted. Enhancing the communication aspect, within and outside the team, e.g., via multimodal user interfaces (Kalisvaart et al. 2004), will be an interesting area for future research and development.

From Solo to Team Sport. Although the heart rate measuring technology is targeted mainly at individual athletics, it was also perceived as useful in the context of team sport for ensuring effective training, setting objectives, monitoring development and motivating the players. Users, especially coaches, could describe detailed multiple uses for the system. Obviously, heart rate information is not enough, and other kinds should also be added – something that is relevant to the sport concerned. Optimal heart rate during exercise will build speed, stamina, etc., but unless the players are able to play as a team, they are not able score goals. Visualizing the locations of players or overall presence in certain areas of the field would be most useful for this. This is in line with Kalisvaart et al. (2004), who suggest both real time and retrospective visualizations to aid coaches in the context of professional football.

Smaller UIs, More Content. Despite their limitations in size, mobile devices and wireless communication will be essential in the future development of the system. People should be able to move around and socialize beside the field. Coaches need mobility as much as parents. In addition, they need to concentrate on what is happening on the field and may not have the opportunity to attend to the devices until later. This poses multiple challenges to UI design. First, the small devices should be able to provide several types of views of large amounts of sensor data from multiple sources. Second, for later retrieval, the users should be able to annotate the data while it is being produced. Third, the system should display data across time. This means not only sensor data from one session, but enabling comparisons and monitoring of progress throughout the season (and possibly beyond).

Provide Background Information. Singular sensor measurements cannot be used for judging a player's actual performance. The system of the future should help the user to read the measurements correctly so that she really understands the physical condition of the player; e.g., improvements over previous achievements or what the figures mean when compared to other players. The *smiley* was the first step in that direction although it was merely hiding information from them instead of helping the users to understand the data. This is perhaps why it was generally ignored and the participants focused on the numbers.

Support Local Reasoning by the Users. It is clear that the system should provide background information about sensor data and its relation to player performance. One should also consider complementary means of enhancing the usefulness of the system. As people are not always willing to read instructions, the system should assist users in their local sense making and exploitation of the sensor data (no matter how arbitrary). This is best done by letting the participants interact with each other. The aim should be that the system of the future supports the types of interpersonal interaction outlined above. For example, if the system enables users to see what other users are viewing at the moment (or in general), it is at least partially helping them to understand or negotiate what it is about these items that is worth monitoring. The UI should provide means for the user to follow individuals, groups, or even average behaviors of larger crowds, so that she can orient her own behavior (following or contradicting) to what others do. This both serves socializing beside the field and helps people to utilize and make sense of the sensor data even when it is incomplete.

5. Discussion: System Intelligence vs. Human Reasoning

Sensors do not just measure the objective state of things. As measurements are taken, particular tools (in contrast to other possible measurements) are given to the participants for viewing and evaluating the situation. With the design, some type of baseline is created.

In our case, the starting point was the context of sport, where one typically aims at *efficient training, maximum performance,* etc. However, the participants *oriented* to this script embedded in the prototype, but did not follow it blindly. As seeing heart rate readings in a completely serious light was not really possible for the participants, nor was it their role either (there are coaches for that), they used the technology for socializing beside the field. The performance-oriented technology served as a conversation starter for social chit-chat consisting of joking, friendly teasing and the like.

This has positive but also unwanted consequences. For example, joking and teasing may be partly serious. On the other hand, for an external analyst, as friends and those close to each other tease each other, it may appear very harsh, although it is not necessarily experienced as such by the participants (Kurvinen 2003). Insofar as co-operative activities constitute group coherence, technology originally designed for individual use was able of supporting it surprisingly well.

In our case, there was a clear mismatch between expectations and doings. When asked, people provided us with the utilitarian and instrumental view associated with the technology. In fact they used the system very differently. There are three ways to deal with this finding:

- First, we can take it that despite its perceived usefulness, the current version of our prototype **did not really assist efficient training,** or perhaps this aspect cannot be addressed in one test session. The participants thus had to make something else out of the system.
- Second, as illustrated in Examples 3 and 5, if the system serves not only as a training tool but as a social catalyst, **people can use it to motivate each other** to improve the quantity or quality of their exercise. The social pressure then may have more effect than any system-made recommendations.
- Third, we should consider whether the **true design potential lies in the interpersonal interactions sensor technology could support.** If so, the context of sport could serve as a home base, a starting-point that legitimates the sensors and motivates people to wear them, while the ultimate usefulness is to be discovered after time-consuming social processes underpinned by the technology.

The notion about design that supports social action is somewhat at odds with how we currently stand in relation to context-aware computing. A common approach to context-awareness is that the system collects tiny bits of information about the situation of the user (such as sensor data) and abstracts that to so-called high-level contextual information. This is then handed over to the user and/or to some applications to describe what the situation is about.

While this all may be difficult to achieve, an alternative approach would be that we *leave the reasoning to the users*. In the domain of CSCW, it has been pointed out that systems need not be highly complex or intelligent to provide support for complex human tasks and human collaboration (Whalen 1995). This means that the system would not have to be context-intelligent at all, but

simply display context-related information to the user, letting her make sense of it together with the people the information relates to.

A similar approach is seen for example in the design of *ContextContacts*, an application that facilitates social awareness by providing contextual information about other people with a help of an augmented mobile phone contact list (Oulasvirta et al. 2005). The information is not computed by a machine in reference to complex semantic structures, but is summarized from raw data in a visual and easily digestible and human-interpretable format.

Our observations show how making sense of the sensor data together with other people – instead of some computer doing it – helped the participants to get to know each other better and provided a joint perspective for watching and experiencing the football game. Furthermore, it appeared to be quite a lot of fun to use the system.

There are caveats to be noted if more reasoning is implemented in the possible next version of the *Wellness-Aware Multimodal Gaming System*. If the system does the inference on behalf of the users, it may take away the very thing that is meaningful for them. This should be turned into a positive design driver towards an intelligent or semi-intelligent system that supports social action and the co-operative reasoning of the users.

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Appendix 1: Transcription Conventions

The examples are written using the Jeffersonian transcription conventions (slightly modified):

(1.0)	Time gap in seconds
(.)	Micropause
=	Latching between utterances
()	Empty parentheses indicate the presence of an unclear fragment on the tape
(---)	Part omitted from the transcript
(guess)	Brackets indicate partially inaudible speech
((comment))	Double brackets contain transcriber's comments
[ ]	Square brackets between adjacent lines indicate parallel speech or action
Under	Speaker emphasis
CAPITALS	Noticeably louder speech
°	Whispering
#	Creak
£	Smiling
@	Animated or emphatic tone
ye:s	Colon indicates that speaker has stretched the preceding sound or letter
↑↓	Arrows indicate rising or falling intonation
>quick<	'More than' and 'less than' signs indicate that encompassed talk was produced noticeably more quickly than the surrounding talk
{action}	Action or gesture

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ARTICLE #6

PROTOTYPING SOCIAL INTERACTION

Esko Kurvinen, Helsinki Institute for Information Technology
Ilpo Koskinen, University of Art and Design Helsinki
Katja Battarbee, IDEO

Abstract

This paper describes three studies that have focused on prototyping the use of mobile multimedia communication technologies. These studies have placed technology prototypes in a social setting and monitored their use over a period of time. We now present the technology and the interpretive methodology employed in these studies to observe uses that evolve over time. We argue that the prototype consists of human action, not so much of the technology that supports it. We also take a more abstract viewpoint, which suggests an emerging paradigm of designing for social interaction. We discuss what is needed to enable an empirical approach to how people interact with each other using emerging, new or not yet generally available technologies.

Key words: design, prototyping, social interaction, mobile multimedia, experience

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1. Introduction

Recent changes in information technology have made social interaction an increasingly important topic for interaction design and technology development. Mobile phones, PDAs, games and laptops have eased interpersonal communication and brought it into new contexts like bus stops, trains, cars, and city streets — in fact everywhere people find themselves and move about. In these situations, the old paradigms of one person interacting with technology, or a group at work in an office or collaborating over a shared system are inadequate in guiding the design of such systems.

For interaction design, these technologies represent new kinds of challenges. Interaction design has inherited its methodic baggage mainly from three sources, none of which specifically focuses on how ordinary people use social technologies. Usability research and human-computer interaction (HCI) seldom quote sociological theory in their premises[1]. While research in computer-supported collaborative work (CSCW) has increasingly focused on questions outside the workplace, the basis of this field of study still stems from studies of the workplace, in which social organization is devised to support work rather than ordinary activities.[2] New articulations of methods and frameworks are required for designing interactive technologies for social interaction in ordinary activities.

This paper describes a series of studies conducted in Helsinki that focused on prototyping how people interact with each other with mobile multimedia. The central claim is that a prototype is not only a representation of a product or technology — such as a paper prototype, a software prototype, or a physical mock-up — but that it consists of both the representation and the social interaction the participants create together. For convenience, we talk about "prototyping social interaction" in this paper. The argument of this paper applies in particular to small communication devices meant for everyday life, but it can also be used with other products and services. Social processes inevitably affect the way in which technology is perceived, accepted and used. If these processes are neglected, designs face risks. In our opinion, there ought to be ways to anticipate at least some of them.

2. Approaches to User Involvement in Prototyping

Buchenau and Fulton Suri[3] define prototypes as "representations of a design made before final artifacts exist." As they note, prototypes range from sketches to different kinds of mock-ups and models.[4] The main aim of prototyping is to produce information for design processes and design decisions, as well as to explore and communicate propositions about the design and its context. From this angle, prototypes serve many purposes. They enable *direct access to challenges and potential solutions*. For example, if the problem is ergonomic, it makes little sense to abstract or theorize about it. In usability testing, prototypes are used mainly to *locate problems in the design and correct these problems* to make use of the product or service more efficient and enjoyable. Prototypes are also *communicative tools* and are sometimes built explicitly for this purpose. For example, in the car industry it is common to build scale or 1:1 models that give an idea of the proposed vehicle. The aim is to communicate the concept and look of the future product, to obtain feedback and to prepare the ground for the new product. Finally, prototypes need not address a predefined problem or product. They serve as *aids for imagination*. For example, quick and dirty experience prototypes can be used when the researchers or developers do not know where to start.[5]

While there is no one way to do prototyping, the role ascribed to the user best distinguishes between possible orientations. In practice, there are several partially incompatible approaches to user involvement. In the *human factors approach*, prevalent in usability engineering and cognitive science, the focus is on the individual's behavior and the cognitive and emotional processes as she runs through a series of preset tasks in front of a prototype. In contrast, the *participatory design* movement, originating in the Scandinavian tradition of workplace design, involves users intensely throughout the design process.[6] The manipulation of prototype-like representations provides a natural and influential slot for user participation in the process, not simply generate useful material for design.[7]

One key differentiator is whether the focus is on the behavior of the users and what sorts of claim are made about it. For example, there are purely *artistic* or *inspirational approaches* to user involvement, such as the cultural probes approach[8] that use imaginative techniques like postcards to collect material from people. The material is used as a backdrop in design sessions, but user studies are not used to test designs or to gain in-depth understanding of people. More typically, *understanding the users' thoughts, dreams, and aspirations* are preferred over mere inspiration. The ultimate interest is not in the observable doings of people, but in their *inner states*, which are regarded as the most important aspect of user-centered design.

The main problem with these approaches is that many products today are designed for interaction, or are used in social interaction almost out of necessity. This is true not just for communications technology, but also for interiors, and many types of games and cars. However, with the exception of teams in information systems design (ISD) at the workplace,[10] prototyping literature typically uses an individual as the main unit of analysis. As many sociologists have noted, there are inbuilt methodological challenges in understanding social activity by looking at individuals only.[11] The problem is that people are constantly reflecting their action onto how others relate to it. Even if it were possible to anticipate how all individuals would behave in the future, we cannot know up front when the paths of two or more people meet and what sort of interaction will be set going. Although individual actors have their say in social action, the process or its outcome is not under the control of any one individual.

This paper is primarily intended to show how one can investigate processes of social interaction involving prototypes. Through a detailed case study, we argue that social interaction is worth taking seriously, and we need to study the ways in which it evolves and affects the ways in which people use prototypes. We show that it is important to understand how people interact with others while using a prototype, and how these interactions affect the way in which individuals use the prototype. Our focus is throughout on practices, what people do, rather than on meanings, what they say.[12] In Bannon's early terms, we study humans as "actors" rather than as "factors."[13] However, we would like to add that Bannon's call requires attention not just to what individuals do, but also to social interaction, which has received little methodological work outside a small circle of CSCW research.[14]

3. Prototyping Social Interaction

This paper describes how our work has tried to respond in its own way to Bannon's programmatic call with lessons learned from CSCW. Our response builds on Buchenau and Fulton Suri's notion of "experience prototyping." Experience prototypes enable design team members, users and clients to gain first-hand appreciation of existing or future conditions through active engagement with prototypes.

> By the term "Experience Prototype" we mean to emphasize the experiential aspect of whatever representations are needed to successfully (re)live or convey an experience with a product, space or system... Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing... When we use the term "Experience Prototyping" we are talking about methods that allow designers, clients or users to "experience it themselves" rather than witnessing a demonstration or someone else's experience... Experience Prototyping is less a set of techniques than it is an attitude, allowing the designer to think of the design problem in terms of designing an integrated experience, rather than one or more specific artifacts.[15]

In our opinion, the key point in prototyping social interaction is that "a prototype" is not a piece of technology constructed to see whether technology works, nor is it something that is "tested" on humans. Instead, the prototype — or a series of prototypes — is a *pair*: there is a representation, typically a new piece of interactive technology, *and* several people using it in ordinary social situations. By social we mean not a general sort of label one could apply to events, but that people are engaged in interaction with other human participants either when mediated by the technology or affected by its presence. The representation creates conditions under which people try to understand this technology, redefine it, develop a stance towards it, and change their behavior and opinions on it in dealing with other people. These observations from social interaction, enabled by the representation, are turned into design drivers. They should be given specific and sustained attention, not treated as another set of variables.

In prototyping social interaction, following a few principles in the design process is more important than the qualities of the actual representation used. The following paradigm describes the conditions required for prototyping social interaction.[16] The intention of this setup is to create conditions in which a social organization involving the representation emerges so that this organization can be observed and described in detail. This understanding can be used as a driver in design, and may perhaps even be modeled.

1. *Ordinary social setting*. More than one person has to be involved in a unit of study to create the conditions for social interaction in a manner that is appropriate for the design context. Social interaction has to take place in a real context to overcome studio-based contemplation.

2. *Naturalistic research design and methods*. People are the authors of their own experiences. They are involved as creative actors, who can and will engage with available products that support them in interests, social interaction and experiences that they find meaningful. Data from people must be gathered and treated using empirical and up-to-date research methods.
3. *Openness*. The prototype should not be thought of as a laboratory experiment. The designer's task is to observe and interpret how people use and explore the technology, not to force them to use it in predefined ways.
4. *A sufficient time span*. The prototype usage ought to be observed for a long enough time, typically for a few weeks at least since it is difficult to get an idea of how people explore and redefine the technology in their actions if the study period is shorter. However, as our third example below shows, one can create prototypes to see how people use the prototype using considerably shorter study periods, provided that the setting is open enough for the participants to freely organize their activities around the prototype.
5. *Special attention to the sequential unfolding of events.* One needs to study the stepwise development of the social process, not simply list its outcomes. Interaction unfolds in time, and has to be considered in temporal terms.

In addition, there has to be a conceptual framework for studying social interaction, which is difficult to understand without a proper framework to guide observations and conceptual work. This requirement does not imply that any particular theory is needed. For example, Battarbee's notion of "co-experience" builds on Dewey's pragmatist philosophy and Blumer's version of symbolic interactionism, a sociological tradition consistent with pragmatism,[17] while Koskinen and Kurvinen build on conversation analysis, an offshoot of classic ethnomethodology.[18] In other studies on our topic, mobile multimedia, researchers have utilized activity theory and the sociology of science and technology.[19] The framework ought to be detailed, well tried in previous research, and open enough to sensitize designers to social interaction. However, since the aim is to identify and describe how orientations and behaviors towards the prototype are created in social interaction, the framework must be inductive in nature. For these reasons, our work has been based on symbolic interactionism and ethnomethodology rather than more formal theories of interaction — such as the notion of gift-exchange.[20]

4. Three Studies

From 1999 to 2002, we conducted a series of studies on mobile multimedia. This paper is based on three of these. The first example is from the *Mobile Image* study, which took place in 1999-2001.[21] We gave a Nokia 9110 and a Casio digital camera connected by an infrared link to four groups of five people for approximately 2–3 months each. The University offered access to a computer system to all participants. Actual messages were collected as e-mail attachments. During the experiment the male and the female groups sent a total of 371 e-mail messages, which became our primary data. The service was free of charge.

The second example is from the *Mobile Multimedia* study,[22] in which we selected three user groups from the Helsinki-based teleoperator Radiolinja's technology and service pilot of their new multimedia messaging service (MMS). The pilot study, which took place in summer 2002, lasted about 5 weeks. Each user was given an MMS phone. Three mixed-gender groups with 7, 11, and 7 members were studied. In all, users sent over 4000 messages during the study, over 2000 being unique (the rest being duplicates in group messages). As in Mobile Image, the service was free of charge.

Our third example, *Mobile Album*, is from a concept study done for Nokia Mobile Phones in 2002. In contrast to our interest in Mobile Multimedia, recent empirical studies of mobile multimedia have repeatedly argued that people show their pictures to other people without ever sending them: phones are largely capture-and-see-devices rather than capture-and-send devices.[23] Mobile Album was specifically constructed to study how people would share experiences with multimedia phones in the presence of others, and how social context shapes the capturing, sharing, and viewing of images. The study also shows how we turned ideas from Mobile Image into a more traditional, low-fidelity prototyping approach. We gave people ten i-Zone Polaroid cameras and a PVC-covered album template. People could cut, paste, and glue their Polaroid stickers on it and simultaneously see what others did with it. The session took place during a one-day picnic party at *Suomenlinna*, an old fortress island and a popular recreation spot located 15 minutes from of Helsinki. Participants were 13 students of Finnish language at the University of Helsinki. The second part of this study, called *Indoors*, was an indoor party with 20–30 guests. Photographing and completing the template took place during a single evening.

Example 1. The Lammassaari Murder Story
Murder at Lammassaari
The long awaited horror movie shots! Unfortunately, I messed up and deleted the first image (but I´ve heard I´m not the only kluntz among us...) The first image was a picture of the murderer´s hand – the story started with a small scratch on Eijas´s hand sometime in the darkest houres of the night at the Lammassaari summer party.
Liisa

Horror at Lammassaari: A murder has been committed!

A body in the grass (note the smile)

The body is found

The murderer runs for it

Plot climax: The murderer is caught...

The murderer gets what he deserves – The Happy Ending

The photographer wins an Oscar, responding to acclaim like a champion

5. Framing Experiences

The first example shows how people may use mobile multimedia for social purposes. In this example, a small and insignificant experience is transformed into something larger than life under suitable conditions by situating it in a story that reframes it. Here, six people first spot a wound, create a murder mystery from it, and organize a simple play, which is recorded with the camera. Eija's wound is "co-experienced" and communicated as a story, not merely an experience.

The title, "Murder at Lammassaari," makes the reader expect a murder mystery. The prologue tells the reader that a scratch on Eija's hand initiated the story. She also explains her blunder: she accidentally deleted the first shot. In the first three images, we see a group of horrified people who witness bloodshed and find a body in the grass. The next three pictures show a runaway murderer, who is caught and punished. The movie-like atmosphere is emphasized in the final image, which underlines the fictional, movie-like character of the episode by referring to the Oscar gala, which situates the story in the safe world of mainstream movies.

This example shows how new technology may enable social interaction in many ways simultaneously. An actual experience in Lammassaari becomes reportable, tellable and shareable because of technology at both the sending and receiving ends. , Activities at parties may of course evolve into plays, but a camera and a phone makes this process different. When there is a camera, the play is specifically staged for it. These people are not experiencing just a play, but a play played for the camera with an eye to sharing it later. Finally, there

was an advertisement at the beginning of the message. That it exists at all shows that this story had been discussed for quite some time before; the information exchange had begun prior to the actual story being shared.

Mobile Image made it possible for us to study ways in which people use a camera and a mobile phone to capture and reconstruct experiences and share them with other people. Among the methods we have explored have been postcards, riddles, teases, questions and answers, as well as stories.[24] In this context, Ling and Julsrud talk about "genres," which, however, we see as a special case of social interaction. Genres — like Hollywood-style murder mysteries — provide conventional means for giving shape to constructing messages.[25] As *Murder in Lammassaari* shows, genres provide important resources for observing, imagining and reporting social activities.

6. Routines and Creativity

While in Mobile Image sending a multimedia message to another phone could take several minutes, in Mobile Multimedia, the process was considerably quicker. As expected, this was reflected in how people used their devices to capture and share experiences with their peers, and forms of social interaction became more elaborate. People were able to not just capture and send experiences but could also respond to messages almost in real time.

Examples of messages that make a response possible but do not require one are reports of good news, insults, good night messages, wish you were here messages, and many others.[26] Sometimes a missing reply is noticeable and may prompt sanctions. If one asks a question, one can expect a quick answer. In Mobile Multimedia, these "sequences" include question-answer pairs, greetings, teases and riddles.[27] These are orderly acts that people use in ordinary life to make sense and to reinterpret their experiences using a piece of communication technology. They also explain a good deal of variation in use over time.[28]

Example 2. Good morning greeting
From Hanna to Tuomas
morning!

In Example 2, Hanna sent early morning greetings to her spouse. It is was one of many greetings sent during the study. As such, it is a good example of an "age-old practice" familiar to anyone from numerous ordinary situations in everyday life.[29] Greeting such as this were typically acknowledged routinely, if replied to at all. These are examples of routinized communication patterns and ways of communicating things and, as such, fit the notion of genres. However, a closer look reveals that people do not merely take this material and shove it in a ready-made set of response types, series or sequences. For example, greetings enable creative spin-offs. Later that afternoon, Tuomas recycles Hanna's tired looking photo, sending a mock personals ad to everyone in the group.

Example 2. (continued)
From Tuomas to all
I am 20, a hot sassy panther lady from the city!
You hunk male, catch me if you dare! –
Always on prowl

Tuomas used this reply to step outside routine communication patterns, and thus opened himself to an affectionate and quick counter attack. Hanna replied with two messages. The first, jocular message consists of a similar ad on behalf of Tuomas, with a primitive wooden sculpture representing him. The second message offers the contents of a diaper to Tuomas, thus displaying her disapproval of the earlier message in a strikingly literal way. She did not have to use a bad word with this picture. After the first message, there was a natural slot for Tuomas to take his turn, but the second reply cuts in and efficiently kills the line of conversation.

Example 2. (continued)
From Hanna to Tuomas
I am Tuomas of the jungle, 37, humby known as the king of the forest. Seeking a wild 60 yr-old jungle woman to come and grab me off the vines. –
Dangling yo-yo

From Hanna to Tuomas
And just for daddy...

The morning greeting above could have initiated a routine exchange of greetings. However, people do not always behave as expected. People may be humorous, witty and, at times, even nasty to each other. Even routine interactions can, and are, exploited in innumerable ways — not in line with the pattern, but to make a point here-and-now. Human activity is often creative, which makes it difficult if not impossible to model; any system built to support communication has to provide room for these outbursts of creativity.

7. Sharing Photographic Experiences as They Happen

Our third example, from Mobile Album, shows how categories emerged in action rather than explicit negotiations. Mobile Image already taught us that the notion of "category" does not properly support action through mobile multimedia. However, as Mobile Image was based on collecting actual messages, it did not provide us with access to what people actually do when they get multimedia messages and decide to respond to them. It was this work that we probed in Mobile Album.

To take an example, one group of images that emerged in Suomenlinna consisted of round shapes. The first images in the series were inspired by one accidental shot in which one participant was eating and her mouth was wide open. Others soon picked up the cue. A few minutes later, there were many similar pictures as some participants started to take pictures of each other's mouths. At this stage, the newly created collection of round shapes was labeled "mouths," after which more pictures of similar or closely related shapes were added, including openings of tunnels and beer cans shot from above.

This example shows that the process of creating the metaphor of "mouths" from the originally descriptive term was stepwise and collaborative. Several people participated in creating the category, which became a source of fun as the mouth metaphor became increasingly more complicated. This example also shows that the abstraction process was social, since several people participated in creating the category, which became a source of fun as the "round shapes" category became increasingly rich in content.

Indoors, the second study of Mobile Album was from a cocktail party situation. We wanted to study how people create meaning in the situation using our experience prototype in the absence of the clear-cut visual structure of Suomenlinna, where the scenic fortress island itself and the easily identifiable physical activities within provided a natural conceptual structure for the event. In contrast, as the main activities in Indoors were socializing, eating, and drinking, there were less visual elements and action to capture on film. Consequently, people started to crop and cut shapes out of photos, create panoramas and collages not only out of photos but also of physical objects such as candies that were glued on the paper prototype. Instead of creating collections of similar objects — as at Suomenlinna — the activity was geared towards editing and manipulating the otherwise monotonous visual scenery. However, although the methods of creating meaning were different, the process was just as social. For example, when we traced the process later from the videotapes, all collages in the template were created collaboratively, the idea of cropping and cutting images with scissors having been similarly picked up from earlier creations by others.[30]

In Mobile Album, our design conclusion was to suggest that any system for storing albums would have to offer the opportunity to keep categories plastic, renameable and open so that people could create and edit categories at will. In contrast, systems relying on ready-made categorization schemes or automated classification systems do not support the discovery and fun inherent in collaborative album building. Furthermore, we argued that the need for image editing or assisted story-telling abilities do not exist in the abstract, but are tied to the nature of the activity; some events are reportable as is, while others cry for assistance of some kind. Our analyses were translated into scenarios of how people classify images into groups, how they turn these classifications into fun, and how classifications, once created, direct social interaction in the future.

8. Discussion

Interaction design has created a knowledge base from a variety of disciplines. Primarily, the field has turned to usability research, cognitive psychology and, to some extent, CSCW in search for concepts and theories. Through these choices, the field tends to have an individualistic tendency. With few exceptions, social action is studied at the workplace rather than in mundane contexts. However, when interaction design has matured, it increasingly has had to address technologies that people use to do things with other people in settings not constrained by the tasks and rules of the workplace.

This paper has described how one can use prototypes in studying social interaction with and through technology. One example has come from a study of one particular technology, mobile multimedia. We have demonstrated that it is possible to study how prototypes function in social interaction. In the three studies reported, we observed how groups of friends and acquaintances invented ways of using mobile multimedia technologies. We have gathered log data, actual messages, interviews and videotapes to make sense of how people invent uses for these representations while interacting with other people. The representations have been at a variety of technology levels from paper-and-scissors to pre-launch products and services.

Our approach to prototyping social interaction was inspired by Buchenau and Fulton Suri's notion of experience prototyping,[31] but our interest is the emergence of social activities rather than how experiences take shape in these activities. Our primary aim was not to create a shared experience that could later be used as a reference point in design work, but to create a setup in which we could analyze in detail how people construct messages, for example, how messages form sequences and how category systems evolve. We have not simply gained insight and inspiration or tested our ideas based on what we have witnessed in our studies, but also described and modeled several social practices for the purposes of product development. Thus, our contribution relates not so much to prototypes *per se,* or their role in providing for user-designer interaction, but to the ways of looking at the data prototypes generate when exposed to social action. This work has partly been based on ethnomethodology and conversation analysis, but insights from these studies have also led to a new understanding of user experience as co-experience, as something people create together.[32] Another difference is that in our opinion, prototyping social interaction requires an even more open approach to prototyping than experience prototyping. If people are given the time and opportunity to explore technology, they will develop uses for it with others.[33] The main similarity is that the prototype does not have to be technologically advanced, detailed in design terms, or expensive.

There are several reasons for prototyping social interaction. Many technologies — for example, mobile multimedia — are inherently social. There is a place for ergonomic and usability studies, but to fully understand the design potential of technology, we need to understand what interpersonal activities it might support. Still, many if not most ways of describing social action use social activities as *resources* rather than study them in detail.[34] In contrast, we treated our prototypes only as bases for social interaction, which became the *topic of analysis*. These studies were not aimed at producing product ideas, but to make sure that such ideas are based on a solid understanding of the intricacies of social interaction and what happens when the prototype is embedded in social action. It is then up to project constraints, design teams and the maturity of organizations to turn this understanding into product ideas. Our approach is more in the tradition of ethnographic research, primarily aiming at better understanding of human behavior in this technological context. It should be judged in terms of its ability to generate theory that helps the design field more generally — not simply in terms of its ability to serve contemporary needs of developers.[35]

Our study has dealt with mobile communications technology. Mobile multimedia have provided us with a perspicuous setting that makes social phenomena observable and reportable in sufficient detail. A similar approach has been used in a variety of other settings such as exploring how audio files can augment photography.[36] This raises the question about whether the prototyping social approach can be applied to "slow technologies" such as intelligent furniture or textiles.[37] Another open question is the place of prototyping social interaction in the design process. The answer to both questions depends on the presumption that our point is conceptual, aimed at advancing a shift in thinking rather than suggesting something totally new for the most advanced design practice. The approach advocated in this paper can easily be adapted to researching, say, interaction with robots or intelligent textiles. If for practical reasons one can do only one prototype, then it is wise to conduct research early on in a design process when design drivers are still open. However, as our examples have shown, research can be conducted at considerably later stages of the design process just as well. In the final analysis, the purpose of prototyping social interaction is not so much about saying what the future product or system should be like. Rather, it is about providing a more accurate description and understanding of the social phenomena related to the product or service idea.

9. Notes

1. Cf. Jacob Nielsen, *Usability Engineering* (San Diego: Morgan Kaufmann, 1993); Jenny Preece, *Human-Computer Interaction* (Harlow, England: Addison-Wesley, 1994).

2. See Andy Crabtree, *Designing Collaborative Systems. A Practical Guide to Ethnography* (London: Springer, 2003).

3. Marion Buchenau and Jane Fulton Suri, "Experience Prototyping," *in Proceedings of Designing Information Systems DIS'00,* New York, The ACM Press, 2000: 424-433.

4. For example, Simo Säde, *Cardboard Mock-Ups and Conversations. Studies in User-Centered Design* (Helsinki: UIAH, 2001); Carl Adams and David Avison, "Dangers Inherent in the Use of Techniques: *Identifying Framing Influences,"* Information Technology & People, Vol. 16, Issue 2 (2003): 203-234.

5. Säde *ibid*.; Pelle Ehn and Morten Kyng, "Cardboard Computers: Mocking It Up or Hands-On the Future." In *Design at Work: Cooperative Design of Computer Systems.* Edited by Joan Greenbaum and Morten Kyng. (Hillsdale, NJ: Lawrence Erlbaum, 1991: 169-195); T. Erickson, "Notes on Design Practice: Stories and Prototypes as Catalysts for Communication." In Scenario-Based Design: Envisioning Work and Technology in System Development. Edited by John Carroll. (New York: John Wiley & Sons, 1995); Anthony Dunne et al., The Presence Project (London: Royal College of Art, 2000).

6. Joan Greenbaum and Morten Kyng , eds., *Design at Work: Cooperative Design of Computer Systems.* (Hillsdale, NJ: Lawrence Erlbaum, 1991): 169-195.

7. R. Budde, K. Kautz, K. Kuhlenkamp and H. Züllighoven. *Prototyping. An Approach to Evolutionary System Development.* (Berlin: Springer-Verlag, 1992: 24-30); Kaj Grønbæk. Prototyping and Active User Involvement in System Development: Towards a Cooperative Prototyping Approach. (Aarhus: Computer Science Department, Aarhus University, 1991). Unpublished Ph.D. Thesis. (http://www.daimi.au.dk/~kgronbak/Thesis/ThesisOverview_ToC.html)

8. Bill Gaver, Tony Dunne and Elena Pacenti, "Design: Cultural probes," *Interactions*, Vol. 6, Issue 1 (1999): 21 – 29.

9. Jane Fulton Suri, "Empathic Design: Informed and Inspired by Other People's Experience." *In Empathic Design.* Edited by Ilpo Koskinen, Katja Battarbee and Tuuli Mattelmäki. (Helsinki: IT Press, 2003: 53). Interestingly, in this context, it has not been asked whether we need to address meanings at all. This discussion has been on for quite a while within social sciences. For example David Silverman proposes an alternative for qualitative research approach; i.e., study of *practices* instead of *meanings*. Cf. David Silverman, "Qualitative Research: Meanings of Practices?" Information Systems Journal 8 (1998): 3–20.

10. Budde *et al., ibid*.; Grønbæk, *ibid*.

11. Howard S. Becker, "Interaction: Some Ideas" (paper presented at the Université Pierre Mendes-France, Grenoble), n.d., http://home.earthlink.net/~hsbecker/, accessed June 15, 2005.

12. David Silverman, *ibid*.

13. Liam Bannon, "From Human Factors to Human Actors. The Role of Psychology and Human-Computer Interaction Studies in System Design." In Joan Greenbaum and Morten Kyng, *ibid*., 1991.

14. Christian Heath and Paul Luff, eds., *Technology in Action.* (Cambridge: Cambridge University Press, 2000); Bonnie A. Nardi, "Studying Context: A Comparison of Activity Theory, Situated Action Models and Distributed Cognition." *In Context and Consciousness: Activity Theory and Human-Computer Interaction.* Edited by Bonnie A. Nardi. (Cambridge, MA: The MIT Press, 1996); Graham Button and Paul Dourish. "On 'Technomethodology': Foundational Relationships between Ethnomethodology and System Design," Human Computer Interaction 13 (1996): 395-432.

15. Buchenau and Fulton Suri *ibid*.: 424-425.

16. Katja Battarbee, *Co-Experience. Understanding User Experiences in Social Interaction.* (Helsinki: University of Art and Design, 2004): 92.

17. John Dewey, *Art as Experience.* (New York: Perigee Books, 1980, original 1934). The notion of experience in Battarbee's analysis depends on Forlizzi, Jodi and Shannon Ford, "The Building Blocks of Experience: An Early Framework for Interaction Designers," *in Proceedings of Designing Information Systems DIS 2000,* New York, NY, The ACM Press, 2000: 419 –423. For the notion of "co-experience," see Battarbee *ibid*.; Katja Battarbee and Ilpo Koskinen. "Co-Experience – User Experience as Interaction," *CoDesign Journal 1* (2004): 5-18. For symbolic interactionism and its relationship to pragmatism, see Herbert Blumer, *Symbolic Interactionism. Perspective and Method* (Berkeley: University of California Press, 1986, original in 1969); and Hans Joas, *G. H. Mead. A Contemporary Re-Examination of His Thought* (Cambridge, MA: MIT Press, 1997).

18. Harold Garfinkel, *Studies in Ethnomethodology.* (Englewood Cliffs, NJ: Prentice-Hall, 1967); Harvey Sacks, *Lectures on Conversations.* (Cambridge: Blackwell, 1995); Ilpo Koskinen and Esko Kurvinen, "Messages visuels mobiles. Nouvelle technologie et interaction," *Réseaux: communication, technologie, société,* 2002, nº 112-113: 107-138; Esko Kurvinen, "Emotions in Action: a Case in Mobile Visual Communication," in *Proceedings of the 3rd International Design and Emotion Conference D+E'02;* Esko Kurvinen, "Only When Miss Universe Snatches Me. Teasing in MMS Messaging," *in Proceeding of Designing Pleasurable Products and Interfaces DPPI'03,* Pittsburgh, Pennsylvania, 2003.

19. Nancy van House et al., "The Uses of Personal Networked Digital Imaging: An Empirical Study of Cameraphone Photos and Sharing," in *Proceedings of Computer-Human Interaction CHI 2005,* Portland, Oregon, The ACM Press, 2005.

20. Christian Licoppe and Jean-Philippe Heurtin, "Managing One's Availability to Telephone Communication through Mobile Phones. A French Case Study of the Development Dynamics of Mobile Phone Use," *Personal and Ubiquitous Computing 5* (2001): 99-108; Sara Berg et al., "Mobile Phones for the Next Generation: Device Designs for Teenagers," in Proceedings of CHI 2003, Ft. Lauderdale, Florida, The ACM Press, 2003.

21. Ilpo Koskinen Esko Kurvinen and Turo-Kimmo Lehtonen, *Mobile Image* (Helsinki: IT Press, 2002).

22. See Ilpo Koskinen and Esko Kurvinen, "Mobile Multimedia and Users: The Domestication of Mobile Multimedia," *Telektronikk* 101, Issue 3-4 (2005): 60-68. Battarbee *ibid*.

23. Tim Kindberg et al., *How and Why People Use Camera Phones.* Consumer Applications and Systems Laboratory, H&P Laboratories Bristol, England, HPL-2004-216, November 26, 2004, available at http://www.hpl.hp.com/techreports/2004/HPL-2004-216.html, accessed August 15, 2004; Koskinen et al. 2002: Ch. 7; Marc Davis et al., "MMM2: Mobile Media Metadata for Media Sharing," in *Proceedings of Computer-Human Interaction CHI 2005,* Portland, Oregon, USA, The ACM Press 2005; van House et al. *ibid*.

24. See Koskinen et al. *ibid*.

25. Cf. Rich Ling and Tom Julsrud, "The Development of Grounded Genres in Multimedia Messaging Systems (MMS) among Mobile Professionals," In *A Sense of Place.* Edited by Kristóf Nyíri. Vienna: Passagen-Verlag, 2005.

26. Battarbee, *ibid*.

27. Cf. Koskinen et al. *ibid.;* Kurvinen 2003; Koskinen and Kurvinen *ibid*.

28. Ilpo Koskinen, "User-Generated Content in Mobile Multimedia: Empirical Evidence from User Studies," *in Proceedings of International Conference of Multimedia and Expo ICME'03,* Baltimore, MD, IEEE Publication, 2003.

29. Alex S. Taylor and Richard Harper, "Age-Old Practices in the "New World": A Study of Gift-Giving

Between Teenage Mobile Phone Users," *in Proceedings of Computer-Human Interaction CHI'02, 2002,* Minneapolis, MN, The ACM Press, 2002: 439-446.

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31. Buchenau and Fulton Suri, *ibid.*

32. Cf. Battarbee, *ibid.*

33. As argued by for example, Mika Pantzar, Kuinka teknologia kesytetään? (Helsinki: Tammi, 1996). [*How is Technology Domesticated,* in Finnish]

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36. David Frohlich, *Audiophotography. Bringing Photos to Life with Sounds.* (London: Kluwer, 2004).

37. Cf. Lars Hallnäs and Johan Redström, "Slow Technology. Designing for Reflection," *Personal and Ubiquitous Computing 5* (2001): 201-212.