

Research Issues in Mobile Informatics: Classical Concerns, Pragmatic Issues and Emerging Discourses

Carsten Sørensen

Department of Information Systems
London School of Economics and Political Science
Houghton Street, London WC2A 2AE, United Kingdom
c.sorensen@lse.ac.uk
<http://mobility.is.lse.ac.uk/>

Defining a Field

The rapid diffusion of mobile Information and Communication Technologies (ICT) such as laptops, mobile phones and to some extent Personal Digital Assistants (PDAs) has along with the uptake of email, instant messaging and other networking services (Sørensen et al., 2002; Mathiassen and Sørensen, 2003) rapidly fueled the mobilisation of interaction (Kakihara and Sørensen, 2001). Since technological innovations easily serve the purpose as focal points for ICT research, the wide-spread diffusion of “mobile” technologies has subsequently led to the emergence of research addressing socio-technical aspects of the use of these technologies. This research has characterized the technology use as ubiquitous computing (Weiser, 1991), nomadic pervasive computing (Lyytinen and Yoo, 2002), or mobile informatics (Dahlbom and Ljungberg, 1998). Lyytinen & Yoo (2002) characterize these as applications using common infrastructures based the combination of mass scale diffusion, mobility and technological convergence. Intuitively, it seems quite straightforward for us to attempt making sense of the rapid technological developments we observe and place the technical characteristics of the emerging phenomena at the center and make it the most important. Hence, we can observe a number of research efforts studying mobile computing, mobile informatics and mobility in general. The commonsensical understanding of mobility in terms of geographical movement is the common denominator distinguishing the mobile phone from the fixed-line phone and the PDA and other hand-held computer devices from the mainframe and the PC.

It could be argued that our field of Information Systems indeed has been born in much a similar way with the mainframe and subsequently the PC at the center, and where the changing ways in which these technologies were brought into use shaped the theoretical focus and conceptualizations from Information Systems to Management Informations Systems (Culnan, 1986). As the debate continues of how to characterize our field (if it indeed is one in its own right) and how to conceptualize the artifacts at the core of our discipline, we experience the “post-dot-com” era questioning the strategic importance of

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ICT investments along with (Carr, 2003; King and Lyytinen, 2003; Madan et al., 2003). Simultaneously, most of the optimism left is channeled into hopes for mobile and ubiquitous technologies propelling a new wave of developments. This has in particular been the case in the Nordic countries, where the early trans-national standard for analogue mobile telephony NMT established a profitable market for companies such as Nokia and Ericsson (Agar, 2003). At the Victoria Institute (www.viktoria.se), for example, design-orientated research based on ethnographic studies has since the Mid-1990s explored the socio-technical aspects of mobile and ubiquitous technologies.

Although it is near impossible (and also undesirable) as a technology-orientated research field to abstract from rapid and dramatic technological developments, it is important that we maintain a critical stance towards defining our research field too narrowly in terms of technological developments. The aim of this position paper is in fact to outline some of the basic issues we need to address as researchers concerning the understanding of current changes in the ways we bring mobile and ubiquitous technologies to use. The assumption of mobile phones enabling “anytime-anywhere” interaction is, for example, one such issue that has been forwarded based on technological properties and with relative little consideration for the actualities of human interaction as we will discuss below. Research must balance a number of potentially conflicting concerns and generally our field experience the tensions generated by the internal system demanding academic rigor, practice seeking workable solutions and the technological development galloping on regardless (Dahlbom, 1996; King and Lyytinen, 2003).

What is Mobility?

When attempting to balance the concerns for academic rigor with the need for worldly relevance and at the same time observe rapid technological developments, there will naturally be significantly varying interests in the various questions that could be studied. King & Lyytinen (2003) argue for the concerns of the three constituents: science, technology and welfare. They argue against the traditional model assuming science inventing technology, which in turn creates welfare. Instead they argue for a model where technological innovation create welfare, which is then studied ex post by science at the same time as science may or may not influence the technological innovation. Here science can be viewed as representing academe, and welfare can partly be viewed as related to commercial concerns, or businesses. It is clear that considering the same technological phenomena, the advent of mobile and ubiquitous computing technologies as is the case here, several diverging fundamental questions may be raised by constituents from academe and from business. Indeed when discussing the possible areas of interest, commercial organizations wish, in particular in the current economic situation, primarily look for efficiency gains. Mobile technologies and almost exclusively assessed based on daily savings. Researchers, however, generally tend to be concerned with the substantial and more theoretically informed changes the appropriation and use of a certain type of technology may lead to. The challenge for current research is to, in a sound and well-

informed way, address both of these concerns, where the former is a more short-term concern than the latter.

As indicated above, one of the main issues is the core definitions of the study of mobile and ubiquitous technology use. So far there is a number of contestants but by far most of the research so far has relied on the commonsensical notion of human movement combined with technologies that are portable and hence mobile themselves. This has resulted in functional characterizations of mobile technology use, e.g. (Kristoffersen and Ljungberg, 2000). At the other extreme, attempts have been made to characterize mobility in terms of the mobilization of interaction emphasizing both the temporal, geographical and contextual aspects of mobilizing interaction (Kakihara and Sørensen, 2001). This perspective argues that the era beginning with the initial mobilization of interaction through the telegraph (Standage, 1998) the past ten years has demonstrated quite radical and violent mobilization of interaction. We have experienced a use of ICT where interaction in terms of the spatial aspects has been transformed from being rigidly geographically bound to move freely across distance. The temporal aspects of interaction were traditionally exclusively defined in terms of linear clock-time, related to the previous point of geographical situatedness. ICTs mediating interaction also challenge our understanding of the temporal dimension of our lives and the rapid mobilization of interaction implies an emergent explanation of the social definitions of temporality mutually shaping and being shaped by the use of technology. We thus increasingly turn to social time as our understanding of time as opposed to a uniformly linearly defined notion of clock-time. Regarding the notion of interaction context, then this was traditionally locally conditions since the interaction could not be rapidly and interactively mediated. The context could act as a filter determining the interactional setting. Increasingly we experience that the mobilization of interaction implies flexible coordination of the context of interaction. For example, the use of mobile phones can cut through the interactional context of thick theatre walls and enforce a certain context for the interaction (Agre, 2001). This of course leads to most mobile conversations attempting to establish where the interactors are and what exactly they are engaged in doing (Weilenmann, 2003). The interactional perspective on mobility allow us to fully comprehend the temporal constraints on working (Yoo, 2003), for example, in terms of compressing time through long-distance interaction or through the stacking of interaction.

It can, however, be argued that this extended mobility perspective placing the mobilization of interaction at the center, explodes the concept of mobility to encompass any human activity involving interaction. It can furthermore be argued that not only is it too general, it is also too narrowly based on a technology-centric understanding of technology use. This has led to the argument that the concept of mobility denoting technological opportunities must be defined dialectically by the sociologically founded concept of stability, based on Giddens (1984) concept of ontological security (Pica and Kakihara, 2003). The argument contra-poses the common techno-centric argument that mobile phones allow people to reach anyone at any point in time with a people-centric argument that people adopt mobile phones to remain in touch with very specific people

such as family, friends and colleagues whom they know well and who forms their existential basis. The “anytime. anywhere” hypothesis has been forwarded by both mobile technology providers and academics, e.g., (Kleinrock, 1996), and criticized by others (Wiberg and Ljungberg, 2001; Kakihara et al., 2002). One of the essential aspects of this debate is the appreciation of the contextual nature of work - many activities simply have to be performed at a certain time, at a certain place and in a relatively narrowly defined context. Here, concerns for the social imply constraining the technological offerings.

Anytime and Anywhere or Sometime Somewhere?

Understanding the issue of enabling interaction anytime, anywhere, with anyone is related to a more principled understanding of technology-mediated human interaction. From a techno-centric perspective the mobile phone for example mainly provide a networking service based on an infrastructure standardizing the connections between clients (Mathiassen and Sørensen, 2002). Networking services generally assume predominant symmetry between the various kinds of people engaging in interaction. However, from a social perspective, human interaction is never symmetrical (Nardi and Whittaker, 2000; Kakihara et al., 2002). Our constant attempts to hide our thoughts and emotions is always surpassed by others’ ability to see through our games (Goffman, 1959). From a pragmatic perspective, we will constantly need to negotiate our interactional preferences against those of the people who either attempt to contact us or those we wish to get in touch with (Kakihara et al., 2002). The technological assumption of interactional symmetry combined with a fundamental social assumption of asymmetry can lead to the experience of interaction overload where the amount of interaction or interactional requests surmount the interactional preferences of the individual experiencing the overload (Ljungberg and Sørensen, 2000). This phenomenon is of course particularly common in situations where highly popular or influential people are inundated with requests to interact and here strict coordination mechanisms along with some form of organizational hierarchy ensure proper management of the person’s time. However, it could be argued that in a world with the technological possibilities of “anytime anywhere” interaction, old established principles for human interaction may not be sufficient or even feasible to support the proper management of interaction. Although our behavior within family or organizational boundaries to a high degree will be regulated by emerging principles and unwritten rules, the mere technical availability combined with decreasing organizational hierarchies, can render individuals helpless in a flood of interaction when it turns out that they for some reason or other generate an interest. In ad hocracies (Mintzberg, 1983) and soft bureaucracies (Courpasson, 2000), knowledge intensive workers may be highly mobile and their interaction intentionally fluid and highly mobilized, but simultaneously their situation may be characterized as having everywhere to go but nowhere to hide.

Modeling the Social

As argued by Latour (1991), technology can be viewed as society made durable. When we innovate and adopt advance infrastructure based mobile and pervasive technologies, then they are of course essentially social technologies. They are primarily personal technologies intrinsically linked to one person, even if they may be subjected to local mobility in a small group context (Luff and Heath, 1998; Weilenmann, 2003). Often they will contain elements of networking services standardizing connections through for example email, voice connections, instant messaging (IM), short messaging service (SMS), or multi-media message service (MMS) (Mathiassen and Sørensen, 2003). The strength of these relatively simple applications based on quite complex infrastructures (Agar, 2003) is that they simply model and standardize the connection, with the associated potential functional weakness of causing interaction overload (Mathiassen and Sørensen, 2003).

If we are to move beyond the simple provision of networking services, then we must fundamentally model aspects of the problem and/or the application domain within the services, for example objects, processes, actors, conceptual structures and actions (Schmidt and Simone, 1996). We can restrict the model to one recording and tracking the state of the field or work, such as car tires being fitted cars on the production line. However, if we are intending to support the coordination of interdependent yet geographically and temporally distributed activities, then it is necessary also to model aspects of the collaboration, for example actors, their roles and tasks, their concrete activities as well as conceptual structures and informational, material, technical and infrastructural resources (Schmidt and Simone, 1996). This implies modeling the context of work, the users and aspects of the social relations (Allen, 1990). As car tires care little about how they are modeled in distributed databases and what as a result are said about them, it is relatively straight forward to re-engineer and optimize processes leading to increases in effectivity. People once aware and informed, however, care very much about what is written about us in databases and what may be said about us as a result. This implies that the potential gains of modeling users, their behavior and context through social technologies can be outweighed by the problems experienced by the constituents represented within the model of the social system. British Airways experienced July 2003 major disruptions when around 250 check-in staff at Heathrow Airport in London walked out in protest of a swipe card system recording personnel movement. The check-in staff feared that the data would be used to flexibly schedule working hours. As a result 80.000 passengers were stranded or delayed.

The issue of modeling and processing even relatively simple data pertaining to actors, their context and activities can not sensibly be separated from concerns of privacy and surveillance. However, it is far from clear what the dynamics of peoples perceptions of acceptable versus unacceptable use of data about them are. It has been shown that display of detailed data about collaborative working may require also modeling the formal hierarchy as a filter for access to this data (Ciborra, 1996). We can, however, also find and example where initial skepticism of recording and displaying key-stroke frequencies

as a measure of whether or not a person can be disturbed being replaced by wide acceptance (Nardi and Whittaker, 2000). As many of the situations where interaction technologies are used to represent, display, model and process social contexts, actors and behaviors inevitably will represent novel scenarios for interaction, it is difficult if not impossible to a priori theoretically determine the opinions and emotions associated. It is therefore reasonable to assume that in order for us to reach the essence of the issues involved we must closely align our theoretically informed inquiries with design-orientated empirical experiments and studies testing user acceptance. In this respect it can be particularly important to recognize the need for cultivating the recalcitrance of participating actors thus ensuring that we do not indeed record behavior conditioned by the inquiries themselves, but instead seek the recalcitrant voices (Latour, 2000; Sørensen et al., 2001).

Software Agency

A separate but related issue is that of software agency, that is our willingness and indeed the appropriateness of employing software to make decisions and to carry out actions on behalf of the user (Schneiderman and Maes, 1997). To some extent this is clearly a core part of the scenario of leaving simplistic networking services by combining them with computational and adaptive services embedding some form of programmed processing (Mathiassen and Sørensen, 2003). Although it can be argued that increasing complexity of ICT use and of our informational contexts may necessitate some degree of automation (Maes, 1994), it is far from clear how this sensibly can be accomplished in the context of personal mobile and ubiquitous technologies. One problem is for example the basic one associated with the relative advantages and disadvantages of awareness and accessibility mechanisms for managing interaction (Ljungberg, 1999; Ljungberg and Sørensen, 2000). The awareness mechanism precisely provides the user awareness about incoming interaction or about others' desire to interact, but it does not in itself stipulate or automate behavior as opposed to the accessibility mechanism, which serves the purpose of embedding decisions regarding the interaction. The strength of the awareness mechanism is that it provides help without the potential for interaction mistakenly being denied or accepted. It, however, for the same reasons therefore does not substantially support the reduction of interaction. The strength of the accessibility mechanism is exactly that it implements filtering behavior supporting the management of interaction and thus implements aspects of agency, albeit with the potential danger of making decisions that subsequently will be deemed wrong. Furthermore, when considering the use of software agency for example in the form of a combination of awareness and accessibility mechanisms, as a support for the management of interaction, then the recursive nature of interaction must be taken into consideration (Schmidt and Simone, 1996).

We can interact in terms of coordinating our work activities, but we can also engage in meta-interaction, that is discussions about when we need to interact and in what ways that could be done. We can even engage in interaction about how and when it is reasonable to negotiate when and how and with whom we should discuss the nature of our interaction aiming at coordinating our operational activities. If, for example, a person is subjected to

a high level of interaction and requests for interaction and therefore wishes some support for the management of the interaction, then an initial investment must be made in establishing a system supporting the management of interaction. As the context of interaction is emergent and may change dynamically over time, the person will at regular intervals need to engage in second-order activities maintaining the interactional preferences of the support technology. For example, the simple classification of names in mobile phone address books according to categories such as Family, VIP, and Others, serves the purpose of engaging an accessibility mechanism filtering and screening calls as well as an awareness mechanism playing different ring-tones depending on the actual callers grouping. However, any changes in the interactional context will require instant changes in the settings of the accessibility and awareness mechanisms, e.g., when should calls from even VIPs be filtered out or when should the sound be at a high level? Also, this simple model would require constant second-order activities maintaining the list of relevant people and their potentially ever-changing status as far as interactional preferences are concerned. It is here quite easy to argue for the initial hypothesis that the advanced filtering options in modern mobile phones probably are not utilized to their full potential simply due to the amount of interaction management needed.

Taylorism the Sequel

The general modeling of the social within the technical, and the particular support for recording, modeling and visualizing individual behavior and interaction can be associated with an emergent debate of the use of advanced social technologies for supporting, automating and managing the work of so-called knowledge-workers. This effort that so far primarily is an issue in practice and has yet to make it into the academic debate has been called Professional Services Automation (PSA). PSA technologies for example support the detailed logging of key-strokes combined with indexing of data- and document-repositories. As a result the systems can provide complex information about the authoring and use of documents, the interactional network through email communication patterns and other aspects of computer-based working. This is of course primarily possible because office-workers extensively work through their computers.

There are of course always several readings of a certain set of phenomena, and one reading of the PSA endeavor is through advanced activity- and interaction-tracking technologies to render the critical work of relatively highly paid knowledge-workers more effective. As such it can be viewed as the second coming of scientific management or Taylorism. Scientific management served several purposes, of which one was to separate the work of the hand from the work of the mind, but it can also be more broadly interpreted as a response to the need for change in the way work was managed as a result of the substantial structural changes experienced when organizations after the turn of the previous Century became increasingly geographically distributed (Yates, 1989). Managing a rail-network across the USA demanded changes compared with managing a small factory where the owner could supervise all activities.

It can be argued that we currently are experiencing another shift in the conditions for managing work as has been argued by several, eg. (Castelles, 1996). Managing knowledge-workers or indeed modern professionals raises a range of unique questions (Newell et al., 2002), and the global market for services provided by professionals demands increased effectivisation of these services for example as a result of increased outsourcing of previously geographically bound services to competitive regions (Schwartz, 2003). PSA can therefore be viewed as the effort to, through the application of advanced Information and Communication Technologies, gaining productivity of white-collar professional who previously to a large extent have been considered self-motivated, self-managed and measured on work outcome. The PSA effort, interpreted as Taylorism Nouveaux, however, provides an analytical lens through which we can see the intricate attempts to manage knowledge-workers. The issue of mobile-PSA has to my knowledge yet to be discussed both in industry and academia, but it is clear to me that the widespread adoption of personal information and communication devices will enable organizations to expand the reach of PSA technologies to cover a wide range of aspects of the individual knowledge-workers life and hence provide further support for automating aspects of the activities.

Units of Analysis

Addressing the unit of analysis for studying mobile pervasive technologies, we obviously can formulate relevant research questions on the level of the individual, the group, the organisation, across organizations and at the level of global infrastructures (Lyytinen and Yoo, 2002). However, the nature of mobile pervasive technologies is such that both the individual and the infrastructure as units of analysis becomes relatively more interesting than previously where the dominant discourse has been that of the organization, at the same time as we see technologies such as PSA being implemented in strict organizational contexts.

Our more specific choices as to what and who we study may also come to question some of the established traditions within our discipline. Whereas we traditionally would study middle-aged people in a working context, we now increasingly see studies of mobile technologies where the purpose is not work but fun and the users are children or teenagers. Traditionally we would also often see a focus on a certain tupe of system or technology, for example studies of EDI or ERP adoption. When studying mobile informatics we need to investigate how to address the fundamental issues without too narrowly defining the field in terms of technologies. There has been some tendency, for example, to define mobile technologies as PDA-based systems. However, when studying modern professionals working practices, it is clear that they employ a range of separate or convergent mobile technologies, such as mobile phones (turning into PDAs), laptops, pagers, mobile email clients etc.

The End

This position paper has aimed at briefly highlighting issues of importance when studying the use of mobile technologies. It has by no means been meant as a comprehensive and

rigorous explanation of how all of the issues are related, That will be left for individual papers. At the London School of Economics we are in the mobility@lse group (mobility.is.lse.ac.uk) currently engaged in a number of projects empirically and theoretically investigating these issues in the context of, for example, the UK police force, professionals in Tokyo and London, banking executives in a global bank, management consultants, mobile learning within the healthcare sector, and the behavior of SMS consumers.

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