

Introduction

One of the many things making mobile computing such an interesting topic of research and design is that it is characterized by rapidly evolving use and is strongly driven by innovation. New technologies and use domains keep emerging, and those that are successful potentially reach millions of users. In the last three months of 2010 more than 100 million smartphones were sold worldwide, outnumbering, for the first time, the sales of personal computers. Echoing this rapidly evolving nature of the area, the industrial lead position in mobile computing has changed several times within only a decade and is most likely to be passed on again in the future. While Apple and Google might currently be in the lead, it is not long ago that this position was taken by Palm, and by Nokia. This obviously motivates researchers and designers to keep innovating and developing new technology and applications.

The research field of Mobile Human-Computer Interaction has informed the development of new mobile technology and applications for over a decade, but is still a relatively young field of research. It has become an acknowledged part of the established research area of computing with a notable presence in mainstream HCI literature and with its own conferences and journals. But it still doesn't have a strongly established and unified identity. This is not to say that there is not a lot of good research and design going on within mobile human-computer interaction. There is indeed. It is, however, still somewhat fragmented, and the field might be better characterised as "being composed of a number of roving tribes who occasionally encounter one another, warily engage, and, finding the engagements stimulating, remain open to other encounters" (Erickson, 2006) rather than as an organised and coherent community.

The advantage of this is, of course, a high level of autonomy, but the disadvantage is less than optimal collective accumulation of knowledge, which may reduce our pace forward to that of incremental steps of each individual piece of research, rather than leaps ahead.

Putting together coherent collections of research dealing with emerging perspectives on mobile device design, use and evaluation, like this book, is a step in the right direction toward establishing such a methodological and theoretical base. To contribute to this, in the following I will be looking back at the last one and a half decades of mobile HCI research in order to establish where we have come from, and how far we have come. I will then turn to looking ahead, and suggest some emerging perspectives on where we should be heading.

LOOKING BACK

My perspectives on Mobile Human-Computer Interaction are based on 15 years of research, mainly in academia. In this research I have, like many others, worked with developing new technologies, designing new applications and services and studying mobile technology in use. As an academic I have also tried

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to elevate our concrete empirical findings to an abstract level of concepts and theory – for example by using the principles of *Gestalt*, and the semiotic concept of *indexicality*, to describe and explain human perception and interpretation of context-aware interaction design (see Paay & Kjeldskov, 2008; Kjeldskov & Paay, 2011). As another area of research, I have worked extensively with mobile HCI methodology, particularly focussing on the challenges of *evaluation*.

In the proceedings of Mobile HCI 1998, Peter Johnson encouraged researchers and practitioners to investigate methods and data collection for evaluating mobile devices. He suggested that “*the conventional usability laboratory would not be able to adequately simulate such important aspects as the weather and could not easily provide for the wide range of competing activities and demands on users that might arise in a natural setting*” and continued by saying that “*data collection methods would be needed that were outside the common range of usability studies*” (Johnson, 1998). Despite this, in a large review of mobile HCI research, presented at the Mobile HCI 2003 conference a few years later, we still found no research focusing on mobile evaluation methodology, and that 71% of all evaluations of mobile devices and services were in fact done in the lab (Kjeldskov & Graham, 2003).

The research survey from 2003 inspired a number of comparative studies on field and lab evaluations of mobile systems with the purpose of investigating the value of evaluating usability in the field. In one of these studies, we compared the usability evaluation of a mobile patient record system in a laboratory furnished as a hospital ward to an evaluation at a real hospital (Kjeldskov et al., 2004). To our surprise we found little added value in the field setting, prompting us to ask the somewhat provocative question “is it worth the hassle?” This study raised a heated debate when presented at the Mobile HCI 2004 conference, and sparked a long lasting discussion in the mobile HCI research community of what methods and techniques are appropriate for evaluation. Looking back, asking this question turned out to be a good thing for mobile HCI research as raising this discussion appears to have inspired, or provoked, a large number of studies. Ten years later the “Hassle” paper is cited more than 200 times, and it is fair to say that it has had a strong impact on the research field by putting the discussion of empirical methodology in mobile HCI on the agenda. As discussed in the follow-up “was it worth the hassle?” paper from Mobile HCI 2014, our methodological toolbox has evolved substantially over the course of 10 years of empirical evaluations, and we now have considerable knowledge and experience with both lab and field studies for mobile HCI. However, perhaps the right question is not *if* or *why* one should evaluate in the lab or in the field, but rather *when* we should do what, and *how* we should then do it. These questions remain largely unanswered in a way that does not simply restate existing disciplinary doctrines (Kjeldskov & Skov 2014). These are questions for the broader mobile HCI research community to address through joint efforts.

Looking more broadly at methodology within the research field of mobile HCI, another follow-up research review from Mobile HCI 2012, found that the field of Mobile HCI research as a whole had grown substantially and had become a substantial part of mainstream HCI research over the last decade (Kjeldskov & Paay, 2012). Out of the 246 full and short papers in the proceedings of the annual ACM Conference on Human Factors in Computing Systems (CHI) in the year surveyed (2010), almost a fifth concerned human-computer interaction with mobile systems or devices. More interestingly though, it was also apparent that the research field had changed methodologically – from being almost exclusively driven by engineering and applied research, to being primarily empirically driven, involving a high number of field studies, and focusing on evaluating and understanding, as well as engineering. However the review also showed that the mobile HCI research field had become divided into two distinct camps of thought, a use- and a technology-centred one, focusing primarily on *people* or on *systems*. The first

aims primarily at understanding mobile user experiences theoretically and conceptually, and the second aims primarily at building new mobile systems and evaluating them in use. Within both approaches *users* play an important role, but in the first they are the *objects* of the research, while in the second they are research *subjects*. This division of course originates in the multi-disciplinary origins of the mobile HCI research field, but maintaining such a divide sadly sustains the unfortunate implicit assumption that people and technology can, or perhaps even *should*, be studied separately in mobile HCI. In turn, such an assumption can be partially responsible for researchers continuing to investigate the same types of questions and problems as before, across the two camps, rather than collaborating closer on defining and exploring new ones.

According to Rasmussen (2007) such clear-cut distinction tends to cause the potentially fruitful dialectics between the two approaches to disappear. If from either side of the divide one of the two approaches is considered 100% good and the other 100% bad, then one is destined to subsume the other. In contrast, as also discussed by Dahlbom and Mathiassen (1993), dialectic thinking encourages us to develop a synthesis at a higher stage of the opposing interests. However, this is not simply a matter of finding a *balance* between the two, but about transcending beyond opposing views and shaping a new unity at another level (Nonaka & Toyama 2002). Hence, in order for the field of mobile HCI research to continue informing the creation of better interactive mobile services, systems and devices, a closer integration of the user- and the technology-centred approaches might be needed.

LOOKING AHEAD

So where should we go from here? What are the emerging challenges and perspectives today that we should be investigating next? In my view the enormous uptake of mobile devices, and the role that they have come to play in our lives, means that mobile computing has evolved from being strongly an engineering profession to being, at least, equally strongly a design profession. Hence, interaction design is today of greater importance for the continuing development of mobile computing than ever before, and there is a need to ensure that our overall approaches to designing and thinking about mobile systems and devices are up for the challenges that lie ahead. In order to do this I argue that we may benefit from exploring, more profoundly, *designerly ways* of thinking and doing (Cross, 2001, 2011), and from widening our scope, more significantly, to look at the contextual user experience of interactive mobile systems and devices, and the larger digital ecosystems they are forming today (Kjeldskov, 2014). In my view, the first emerging challenge for mobile HCI research today is to transcend beyond the dichotomy of people- or technology- oriented research and design. Continuing such a divide, we are at risk of missing the holistic nature of the mobile interaction design challenges currently at hand, now that mobile technologies pervade almost every aspect of our lives. What is instead needed is to “reconceptualize the domain of interest through using a modified unit of analysis” (Rogers et al., 2005) – creating a shift in focus where new and shared problems are framed in a way that force new ways of thinking and doing, while still allowing room for existing knowledge, concepts and theory. The second emerging challenge for mobile HCI research today is to widen our scope beyond the individual mobile system, service, or device, and individual users’ interactions with it. Individual systems and devices have been researched in depth for over a decade, in both artificial and natural settings, and are now understood quite well. What is *not* yet understood very well is mobile human-computer interaction within the larger context of everyday life, and the use of mobile technology in concert with all the other interactive technologies

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surrounding us. Hence, we need to look beyond user interaction with individual systems toward human orchestration of systems of systems – or as they have also been labelled, “artefact ecologies” (Bødker & Klokmoose, 2011) or “digital ecosystems” (Sørensen et al., 2014; Levin, 2014).

In order to do this, I have previously put forward three concrete suggestions for future thinking in mobile HCI research (Kjeldskov & Skov, 2014):

1. Move beyond focus on usability and usability evaluations;
2. Move beyond non-wild field studies;
3. Move beyond snap-shot studies of use.

Move Beyond Usability and Usability Evaluations

Firstly, I would like us to consider whether focusing on usability and doing usability evaluations are really what we ought to be doing when studying mobile HCI? In line with Rogers et al. (2007) one might propose that continuing to focus on usability simply fails to capture what we really need to understand when studying mobile systems, services, and devices in use. It can also be argued that after 15 years of mobile HCI research and design, we have become pretty good at designing interfaces that people can operate on a mobile device in a mobile context. Where the research challenge 15 years ago was to achieve usability on small displays and with limited means of input, processing power and network speed, for people away from their desk, the research challenge today, and what we need to learn more about, is about designing services, devices and interactions that fit well into people’s complex lives, for work and leisure, and that fit well with the abundance of other technologies that we surround ourselves with. Hence, the key research challenge for mobile HCI is perhaps no longer usability, and hence, usability evaluations are perhaps no longer an appropriate method for evaluation. In this challenge usability is just a basic condition, like bug-free code is. Doing good usability will not get us there in itself, and therefore neither will usability evaluations – regardless if they are done in the lab or in the field. Moving beyond a focus on usability might be a useful prompt for approaching field studies in a different way. Rather than trying to “fix” the issue of limited control in the field by introducing experimentation, such as usability evaluations, why not consider the opposite direction and purposely let go of researcher control? This leads me to the second suggestion for an emerging perspective.

Move Beyond Non-Wild Field Studies

Secondly, I would like us to consider how we do field studies. Over the last decade the level of empirical research in mobile HCI has increased, and a more diversified set of methods has evolved and been put into use (Kjeldskov & Paay, 2012). This is has particularly been the case within the broader methodological category of field studies, which has diversified into at least three noteworthy sub categories of *field ethnographies*, *field experiments*, and *field surveys*. This is good news because it indicated a growing focus on real-world studies and use-in-context. However, there appear to be quite varying understandings of what constitute the field – from sitting in a train or walking around the center of a city, to conducting an evaluation in the immediate area outside a research center building (for a detailed discussion, see Kjeldskov & Skov, 2014). In light of this, one might propose that a field study that does not really take the researcher into an uncontrolled real world situation is perhaps not a good one. The main value of the field is that it is *real* and perhaps *messy*, and not an amputated or watered down version of reality. That

is perhaps also why the labels “in-situ” and “in-the-wild” have recently been adapted by some papers (e.g. Brown et al., 2011; Crabtree et al., 2013; Høegh et al., 2008; Jambon & Meillon, 2009; Rogers et al., 2007; Roto et al., 2011; Wilson et al., 2007) as they are in fact really much better at capturing the essence of what field studies really *should* be about. Field experiments are fine as ecologically valid alternatives to lab experiments, but perhaps not as a controlled alternative to field ethnographies. When going out of the lab, we ought to make it across the parking lot and all the way in to the wild. We should embrace the wilderness, rather than trying to tame it.

Move beyond Snapshot Studies of Use

Thirdly, and related to the previous two suggestions, I would like us to consider the duration of our empirical studies. When moving beyond usability evaluations, and beyond non-wild field studies of mobile systems, services and devices, we should also be doing our studies in a longitudinal manner. As piece of legacy from the tradition of usability engineering, we have perhaps grown accustomed to grounding our knowledge in “snapshots of use” rather than repeated and sustained use over longer periods of time. This is not only true for studies in laboratories, but also for several field studies. This is especially the case for the growing body of field experiments, but also for most of the ones using field ethnographies for evaluation. This is not a good thing, as it stops us from learning anything about what really happens when our prototypes and designs are used over longer periods of time. Hence, one might propose that if we are to address issues beyond usability and truly embrace going into the wild, we should also to start embracing longitudinal studies more. Perhaps we should even entertain the thought of sacrificing direct researcher involvement in order to stretch out the time that our systems are deployed in the field. Studies like that already exist in the literature, with the work of Streefkerk et al. (2008) being a really interesting example of a longitudinal study in the wild that does not focus on usability. More studies like this will surely give us valuable information on mobile systems in use in the near future.

EMERGING PERSPECTIVES

The chapters included in this book contribute to moving the research field of mobile human-computer interaction forward by addressing some of these emerging perspectives. As such they aim at expanding the scope of mobile HCI research for the decade to come, and exemplify some of the new challenges and opportunities that lie ahead. As you will see from this collection of chapters, these are interesting times to be doing mobile HCI research and design. There is a lot of good work being done, and some of it is beginning to move beyond usability and usability evaluation, embracing the wildness of the wild, and moving beyond snapshot studies of use.

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