Preface

INTRODUCTION

As mobile devices become increasingly diverse and continue to shrink in size and weight their portability is enhanced but, unfortunately, their usability tends to suffer. Ultimately, the usability of mobile technologies determines their future success in terms of end-user acceptance and, thereafter, adoption and social impact. Widespread acceptance will not, however, be achieved if users’ interaction with mobile technology amounts to a negative experience. Mobile user interfaces need to be designed to meet the functional and sensory needs of users. In recognition of this need, a growing research area focusing on mobile human-computer interaction has emerged and will likely continue to grow exponentially in the future.

Successful desktop user interface design does not automatically equate to successful mobile user interface design. This is due to (a) the resource disparity between mobile and desktop technologies themselves, and (b) the extent to which users can allocate their attentional resources to the technologies, given the disparity of contexts in and purposes for which mobile and desktop devices are typically used. Additionally, the form factor of mobile devices typically limits the applicability of standard input and output techniques, making mobile human-computer interaction design ineffective if we insist on adhering to the tried and tested desktop paradigm.

The design and evaluation of mobile human-computer interaction, unlike desktop-based interaction, needs to be cognizant of the implications brought to bear by complex contextual factors affecting both users and technology. Such contextual influences include, but are not limited to, the physical environment in which a mobile device is being used, the impact of multitasking behavior typically exhibited by users of mobile devices (e.g., using a device whilst driving), and the social context in which a device is used. Furthermore, mobile technology can go where desktop technology cannot reach – in particular, it has immense potential in an assistive capacity for special needs users and in disaster management scenarios. With such widespread applicability of mobile technologies, when designing mobile technologies, we must strive to be suitably cognizant of their potential social impact – that is, their potential acceptability as well as the influence they may bring to bear on the society into which they are introduced. All in all, designing the user interface for mobile applications is a very complex undertaking which is made even more challenging by the rapid technological developments in mobile hardware.

Not only is the design of human-computer interaction for mobile technologies difficult, so too is the evaluation of such designs. Evaluation techniques for mobile technology require as much consideration as the design of the user interfaces themselves; for the results of evaluations of mobile applications
to be meaningful, the manner in which the evaluations are conducted needs to be, and is, the focus of considerable research in itself.

This Advances book is a compendium of articles from the inaugural volume of the *International Journal of Mobile Human Computer Interaction (IJMHCI)*. The mission of the IJMHCI is to provide an international forum for researchers, educators, and practitioners to advance knowledge and practice in all facets of design and evaluation of human interaction with mobile technologies; to encourage readers to think out of the box to ensure that novel, effective user interface design and evaluation strategies continue to emerge and, in turn, the true potential of mobile technology is realized whilst being sensitive to the societal impact such technologies may have. The IJMHCI brings together a comprehensive collection of research articles from international experts on the design, evaluation, and use of innovative handheld, mobile, and wearable technologies; it also considers issues associated with the social and/or organizational impacts of such technologies. Emerging theories, methods, and interaction designs are included and are complemented with case studies which demonstrate the practical application of these new ideas.

The aim of the journal is to increase exposure to, and heighten awareness of, the complexity of current and future issues concerning mobile human-computer interaction. In its inaugural year, and over the life of the journal, articles have presented (and will undoubtedly continue to present) alternative points of view for some of the field’s hotly debated topics. Such variance is not only stimulating but also essential in terms of encouraging readers to think to the future and embrace the challenge of new paradigms both for interaction design and evaluation.

**NEW BEGINNINGS**

The inaugural volume of the IJMHCI comprised 4 issues which, collectively, highlight the vibrant nature of the field of mobile HCI and showcase some of the interesting and exciting work that is being done.

The first five articles included in this publication appeared in the very first issue of the IJMHCI. The articles were selected for inclusion from the top-ranked, peer-reviewed chapters of the *Handbook of Research on User Interface Design and Evaluation for Mobile Technology* – the IGI Global publication that triggered the establishment of the IJMHCI. Collectively, these articles touch on some of the most important issues and questions related to mobile human-computer interaction. In the first article, entitled “*Instrumented Usability Analysis for Mobile Devices*”, Andrew Crossan, Roderick Murray-Smith, Stephen Brewster and Bojan Musizza introduce the concept of using sensors (such as accelerometers) to elicit quantitative, objective information about the “moment to moment” actions of users as they interact with mobile technology. Instrumented usability analysis such as the method proposed by Crossen *et al.* is really important for supporting evaluation of mobile and wearable devices which cannot be realistically tested without artificially constraining users; using their method, Crossen *et al.* are able to explore, for example, the impact of gait on input error when using touchscreen technology in motion. An ability to conduct evaluations such as those enabled by Crossen *et al.* helps us move towards better and effective design for user interfaces intended to be used when truly mobile.

The second article, written by Enrico Bertini, Tiziana Catarci, Alan Dix, Silvia Gabrielli, Stephen Kimani, and Giuseppe Santucci, is entitled “*Appropriating Heuristic Evaluation for Mobile Computing*” and describes a modified collection of usability heuristics that are designed to be appropriate for heuristic evaluation of mobile technologies. Heuristic evaluation has proven effective and popular for desktop-based user interfaces over the years. Although mobile computing shares some usability issues with
traditional desktop-based user interfaces, there are numerous additional challenges to usability brought about by the form factor and contexts of use of mobile technologies. The modified usability heuristics presented by Bertini et al. embrace these additional challenges to allow the recognized advantages of heuristic evaluation to be effectively applied to mobile user interface design.

In the third article, by Mark Dunlop and Michelle Montgomery Masters, entitled “Pickup Usability Dominates: A Brief History of Mobile Text Entry Research and Adoption”, the authors review mobile text entry techniques based on smaller keyboards and touchscreens and reflect on the nature of the evaluations that have been conducted to assess their validity. The article also reports on an initial assessment of iPhone text entry rates. As noted by Dunlop and Montgomery Masters, text entry on mobile devices has presented, and continues to present, a research challenge for emerging mobile technologies. The authors’ reflection on past developments and assessment of technology that is rapidly becoming mainstream is essential for our understanding of this field, both in terms of text input mechanisms and effective means by which to evaluate their efficacy.

The fourth article – “On-the-Move and in Your Car: An Overview of HCI Issues for In-Car Computing” – by Gary Burnett outlines a very specific mobile use case – the driving context – and highlights the range of computing systems (and associated user interfaces) being introduced into this context. The article describes the factors that designers of user interfaces to in-car technologies must consider, compares the various facilities available to support the design and evaluation (e.g., simulators, instrumented vehicles) of such systems, and highlights continuing research challenges in this field.

The fifth article was written by Eija Kaasinen et al., and is entitled “User Acceptance of Mobile Services”. It asserts that usability alone does not determine user acceptance of mobile services and introduces the Technology Acceptance Model for Mobile Services (TAMM) which models the way in which a complex set of user acceptance factors affect users’ mobile service acceptance. Given the complexity and variety of contexts in which mobile technologies may be used, it is essential that we appreciate the “bigger picture” affecting the acceptance of these technologies; only in full knowledge and recognition of these factors will we be able to best, and effectively, design mobile systems of the future.

Advancing the Evaluation of Mobile and Ubiquitous Systems

Continuing a recurring theme amongst the articles already outlined, the second issue of the IJMHCI was a special issue on Advances in Evaluating Mobile and Ubiquitous Systems guest-edited by Katie Siek, Steve Neely, Graeme Stevenson, Christian Kray, and Ingrid Mulder. Currently, evaluators of mobile and ubiquitous systems lack the generally accepted methods, benchmarks, and guidelines available to evaluators of traditional, desktop-based systems. Furthermore, there is a lively ongoing debate as to the appropriateness of lab- v. field-based evaluation approaches for mobile technologies. The collection of articles – each of which represents the best paper from a series of independent workshops – comprising the special issue go some way towards establishing an agreed upon set of usability methods for in situ evaluation. In their detailed preface to the special issue, the guest editors provide background and motivation for their issue; to situate the ensuing showcase of best papers, they introduce and discuss the collection of workshops relevant to the theme of their special issue and from which the best papers were selected – in itself, this discussion presents a useful roadmap of venues in which cutting edge research on evaluation methods is presented and discussed at an international level; interested readers should refer to IJMHCi Vol. 1, Issue 2 to read the preface itself.
The paper by Jörg Muller, Keith Cheverst, Dan Fitton, Nick Taylor, Oliver Paczkowski, and Antonio Krüger, entitled “Experiences of Supporting Local and Remote Mobile Phone Interaction in Situated Public Display Deployments”, notes the increasing ubiquity of public displays and mobile phones and the exciting possibilities offered by the combination of the two technologies. Muller et al. also note, however, that “current usability evaluations [...] have explored only a small part of this design space, as usage of such systems is deeply embedded in and dependent on social and everyday context”. The authors report on six different field deployments, ranging from exploratory prototypes to technology probes, of systems that combine both mobile phone and public display technologies; they discuss the advantages and disadvantages of different evaluation methods applied in such contexts and reflect on the challenges faced when conducting field studies involving public displays and mobile devices.

In their paper entitled “Lessons out of Chaos: Lessons Learned from the Noise of Non-Traditional Environments”, Antony Glascock and David Kutzik reflect on seven years’ worth of experiences evaluating a behavioral monitoring system in a range of real-world environments, from a living suite in a hospital to home-based deployment within large communities. The authors emphasize the role that what might initially be perceived as “noise” can play in the evaluation of a mobile system.

Scott Sherwood, Stuart Reeves, Julie Maitland, Alistair Morrison, and Matthew Chalmers present a paper entitled “Large Scale User Trials: Research Challenges and Adaptive Evaluation”. In this, Sherwood et al. note that ubiquitous systems are designed to be embedded into the daily lives of users and, as such, must go through a process of integration and appropriation. Reflecting on a series of studies of ubiquitous technologies which saw evolution of their evaluation process to accommodate the inherent difficulties of true field-based assessment, they argue that evaluation methods for such systems need to become more adaptive in order to support the effective study of emergent uses of ubiquitous technologies over time.

In the final paper of the special issue – “Experimental Setups for User Evaluation of Mobile Devices and Ubiquitous Systems” by Francis Jambon – lab- and field-based evaluations are compared. Jambon discusses the “uncertainty principle” and introduces a new evaluation technique – the “Trojan Horse” technique – designed to partially overcome the consequences of the uncertainty principle. Jambon proposes a method to make complementary use of both laboratory and in-situ (field) experiments for the evaluation of mobile technologies.

### Enhancing the Mobile Internet User Experience

Motivated by two workshops on Mobile Internet User Experience (MIUX), and guest edited by the workshops’ organizers (Virpi Roto and Eija Kaasinen), the inaugural volume of the IJMHCI also played host to a special issue on MIUX. With a focus on solutions for improving the user experience when using the internet on mobile devices, the articles associated with this special issue include extended submissions from the workshop attendees as well as articles from other eminent researchers working in this field. In their informative preface to the special issue, Roto and Kaasinen set the scene for MIUX research and provide strong motivation for the work in this area. In drawing together their collection of articles, Roto and Kaasinen illustrate the variety of avenues in which work is currently being done to improve the mobile internet user experience and encourage researchers in the field of mobile HCI to take up the challenge and continue work in MIUX; interested readers should refer to IJMHCI Vol. 1, Issue 4 to access the preface itself.
To headline their special issue, Roto and Kaasinen invited Evan Koblentz, a technology historian with a specialization in the history of portable computers, to author an article entitled “How it Started: Mobile Internet Devices of the Previous Millennium”. In describing the ancestry of current mobile internet devices, Koblentz eloquently provides a perspective for the subsequent research articles.

A collaborative effort from several of the MIUX workshop participants – namely, Eija Kaasinen, Virpi Roto, Kristin Roloff, Kaisa Väänänen-Vainio-Mattila, Teija Vainio, Wolfgang Maehr, Dhaval Joshi, and Sujan Shrestha – led to the article entitled “User Experience of Mobile Internet: Analysis and Recommendations”. As the title suggests, this article provides a comprehensive overview of topics of research in the field of MIUX, identifying factors that make internet use on mobile devices an enjoyable experience. Discussing the many ways in which the mobile internet user experience could be improved, this article provides some concrete development recommendations for improving users’ experiences and serves as an ideal introduction for readers and practitioners new to the area of MIUX.

In their article entitled “How People Really Use the Mobile Web: A Framework for Understanding Motivations, Behaviors, and Contexts”, Carol Taylor, Nancy Samuels, and Judith Ramey report on their study which was designed to discover (for US mobile phone users) what motivates users to explore the web on their mobile phones, what people do when browsing the web on their phones, and where they choose to access the web using a mobile device. On the basis of their study, they developed then validated a taxonomy of behaviors, motivations, and contexts associated with mobile web use. This framework helps readers understand the “bigger picture” of mobile web use.

In “Improving the User Experience of a Mobile Photo Gallery by Supporting Social Interaction”, Elina Vartiainen presents a case study on improving the mobile internet user experience for an internet-integrated photo-sharing application. By reflecting on her experience designing and developing the application, Vartiainen highlights aspects associated with mobile user experience from which other developers can benefit. As noted by Roto and Kaasinen, Vartiainen’s article “provides us with a glimpse of future internet services for mobile devices, where data connection costs do not prohibit good user experiences”.

The final article of the MIUX special issue is entitled “Touch-Based Access to Mobile Internet: Recommendations for Interface and Content Design”. In this, Minna Isomursu and Mari Ervasti report on user experience findings from two different field trials in which the advantages of touch-based interaction for content and service discovery, mobile internet access, and integrated situated and embodied experience are highlighted. Isomursu and Ervasti argue that touch-based access creates a semantic bridge between the physical context of use and the MIUX, meaning that the user experience manifests as a seamless convergence of the physical and digital worlds.

Research Challenges for Mobile HCI

The IJMHCI would not be possible without the advisory team who work together to lend strength, passion, and inspiration to the journal. The efforts of journal advisors oftentimes pass relatively unnoticed; their association with a journal is listed, but the true extent of their contribution and value often remains hidden. The IJMHCI is honored to boast a dedicated, talented, and truly motivated group of advisors – each committed to helping the IJMHCI realize its potential. The International Advisory Board members include: Anne Kaikkonen, Nokia, Finland; Fabio Paternò, CNR, Italy; Jakob Nielsen, Nielsen Norman Group, USA; Matt Jones, Swansea University, Wales; and Stephen Brewster, University of Glasgow, Scotland. The team of Associate Editors includes: Antti Pirhonen, University of Jyväskylä, Finland;
Gary Burnett, University of Nottingham, England; Gitte Lindgaard, Carleton University, Canada; Janet Read, University of Central Lancashire, England; Jesper Kjeldskov, Aalborg University, Denmark; Mark Dunlop, University of Strathclyde, Scotland; Roderick Murray-Smith, University of Glasgow, Scotland; and Russell Beale, University of Birmingham, England.

In working towards the inaugural volume of the IJMHCI, I asked the journal’s advisors to reflect on what it takes to make a journal great. Unanimously, they agreed that, for a fledgling journal (especially one in a discipline such as Mobile HCI which is, compared to others, in its relative infancy), it is important to essentially posit research challenges to readers such that researchers gain a clear perspective on the goals and directions of the journal and the field in general. Given the range of research expertise represented by the journal’s advisors, I felt that to invite the advisors to submit position papers which outlined their personal take on the future of mobile HCI as a discipline, and to suggest where we need to focus in the future (10 years, say) would generate a thought provoking and challenging issue for our readers. Hence, the inaugural volume of the IJMHCI came to include an issue which represents a collection of personal reflections on the future of mobile HCI, the challenges it presents, and the potential opportunities it offers; in essence, an opportunity to step back and reflect on or assess our position, achievements, and our future societal and innovative obligations as mobile HCI researchers. I asked that, where applicable, the advisors be deliberately controversial such that this collection of position papers by eminent mobile HCI researchers evokes thought and debate amongst readers; the goal is that the position papers will collectively act as a catalyst for other researchers to take up the challenges presented – if they have not already – or to contradict/refute the positions presented, and to subsequently engage in high quality, interesting work which will spark further interest and debate, thus continuing the catalytic momentum which was intended by this particular issue of the IJMHCI.

In the first position paper – entitled “What does Mobile Mean?” – Russell Beale questions what we really mean by mobile human-computer interaction. He argues that, to date, mobility has been defined by the portability of a device and that this has, in turn, defined the way mobile applications have been designed. Russell contends that the real issue is not device mobility but rather user mobility. He notes that when we consider users and their mobility, rather than focus on the technology itself, other interaction opportunities become apparent – a theme that is picked up in later position papers by Roderick Murray-Smith and by Gitte Lindgaard and Sheila Narasimhan. Russell suggests four characterizations of user mobility – the modern worker, the migratory worker, the nomadic, and the twitterer – and elaborates on their implications for future mobile HCI design and research. He identifies some of the potential benefits and most effective uses of well designed applications for mobile users, some of which allude to the ethical dichotomy introduced by Antti Pirhonen and Elizabeth Sillence in the second paper, entitled “ICT for Consumers or Human Beings: What’s the Difference?”.

In their paper, Antti and Elizabeth discuss the impact on our culture of large scale deployment of mobile applications. In this deliberately controversial paper, they ask whether we, as a research community, need to take more of an active role in discussing the ethical issues associated with the technology we research and develop – that is, to consider more fully the ethical problems resulting from the rapid penetration of mobile applications. They argue that many of the research techniques we currently adopt, whilst contributing to the usability of a product, tell us very little about the more complicated ethical issues involved. From “roasting our brains” to being “chained” to our work to the dissolution of family life, Antti and Elizabeth explore the broader societal impact of mobile technologies as they affect our welfare. They suggest that the term “human” – as currently used in “human-computer interaction” – is misleading and that current trends in our discipline could be better reflected with more appropriate
wording – e.g., “user” or “consumer” rather than “human”. They suggest that we should reserve the term “human” for research motivated by a desire for better understanding of humanity, and thus the construction of a better world; in effect, they soberingly remind us that as the designers and practitioners of today we are “creating all of our tomorrows”.

Taking a different perspective to the previous paper, Roderick Murray-Smith (in “Empowering People Rather Than Connecting Them”) considers the ways in which mobile technologies can empower rather than simply connect users. He argues that the emergence of modern technologies, such as increasingly sophisticated sensors, create the potential for novel interaction paradigms as well as scope for instrumented usability evaluation techniques. He suggests that, with additional sensory perception embedded in mobile technologies, interesting and unpredictable social behaviors will emerge. Your take on the ethical quandaries presented by Antti and Elizabeth will color whether you believe this to be potentially good or bad, but Roderick makes a compelling argument for research that will lead us towards an environment which is controlled by those who inhabit it and which, in turn, empowers rather than enslaves its inhabitants. Envisioning future interaction akin to dancing – “a sympathetic ebb and flow of control between the user, their mobile device, and the broader environment” – Roderick examines the future of location-based interaction, and highlights some of the research challenges that need resolution in order to progress.

In “Mobile Internet: Past, Present, and the Future”, Anne Kaikkonen asks what we learned from the first years of WAP and whether or not it constitutes a valuable step on the path towards effective web access on mobile technologies of the future. She raises the questions of when we need mobile-tailored content as opposed to full web content, as well as how best to design websites that accommodate access on both desktop and mobile computers. She metaphorically maps full web browsing on a mobile device to free diving, browsing mobile-tailored websites on mobile devices to snorkeling with occasional deeper dives, and internet use via mobile applications as snorkeling in a swimming pool. Related to Russell Beale’s suggestion that we should be designing for the mobility of users, Anne stresses the importance of developing web content that is tailored to suit mobile use; she suggests that most users access the web on different devices (e.g., desktop PC and mobile device) and so there is a need to support user mobility by making browsing compatible based on, and across, devices and contexts. Anne, like Antti and Elizabeth, reflects on the need for our discipline to consider what people do (in terms of web access) and why, rather than just the usability of devices and user interface designs; she also touches on concerns about the social dichotomy of being ‘always connected’ versus an individual’s need for personal privacy or space. Linking the papers of Roderick and Antti and Elizabeth, Anne discusses the ability for our mobile devices to gather information about our physical environment but leaves us with a cautionary reminder of our obligation to “think about, and evaluate, the potential side effects on people’s lives of the systems we create” – stressing that it is our responsibility to do our utmost to minimize the negative without compromising on the positive.

Gitte Lindgaard and Sheila Narasimhan – in their paper entitled “Novel Technologies and Interaction Paradigms in Mobile HCI” – draw on elements inherent in all of the preceding articles and encourage us to think beyond that to which we are accustomed, and to explore the possibilities offered by mobility, mobile technologies, and people on the move in terms of developing novel interaction paradigms. They suggest that the range of possible applications which could ultimately make our lives easier are limited only by our imaginative understanding of problem spaces and the potential to combine existing, and invent and validate new, methods of interaction. They note that, for mobile user interfaces, user safety must be of concern despite its seemingly direct contradiction of the accepted goal of engagement. They
go beyond the use of sensors as discussed by Roderick to explore the future for sensory substitution – e.g., for visually impaired users – in addition to discussing the complexities associated with designing user interfaces for other special needs user groups, such as illiterate adults. Complementary to the evolution of interaction techniques is the need to evolve data collection and usability evaluation methods for mobile systems; arguing that there is a place for both lab and field studies in Mobile HCI, Gitte and Sheila encourage us to consider how best to adapt, substitute, or replace investigative methods that “maximize our understanding of contextual constraints on users, usability, and usage patterns”. They urge us to be inventive in our approach to interaction design as well as to invent “novel approaches to understanding users, designing for users, and evaluating the fruits of our collective labor”.

“Designing Mobile Phones for Children: Is there a Difference?”: Janet Read certainly thinks so as outlined in her position paper which looks closely at the differences between children’s and adults’ use of mobile phones and the associated implications in the design of these devices. As mobile phones are increasingly appropriated by younger and younger users, Janet argues that the design of mobile phones needs a re-think in order to best meet the needs of this new user group. In her work with children as technology users, Janet is clearly taking up the gauntlet laid down by Gitte and Sheila in terms of better understanding her users, and focusing on how we can better design for them. She acknowledges that the mobile phone is “simultaneously lauded as a great device and reviled as a destructive irritation”; in discussing the potential benefits of mobile phones – both from a future technological perspective and from the perspective of parents who are pro such technologies – Janet notes that “there is a very fine line between being in touch with a child and the child being surveilled”, an issue which clearly links the discussions of Russell, Antti and Elizabeth, and Roderick. As a proponent of the capacity for mobile phones to benefit children, Janet considers that such technologies for children should be designed to meet their needs and, to this end, presents a series of design ideas to address some of the most serious and common problems with their current design.

In his paper entitled “SatNav or SatNag? A Case Study Analysis of Evolving HCI Issues for In-Car Computing”, Gary Burnett also imbues many of the elements concerning the meaning of being mobile and the ethical issues associated with user interface design (as per the previous articles by Russell and Antti and Elizabeth, respectively) – in this case, specifically those associated with designing in-car systems where safety concerns dominate. Gary introduces the 4 primary tensions inherent in the design of any in-car system, reflecting on their respective impact on the methods, tools, and user interface design practice employed in this domain. Using a case study which focuses on the design of a vehicle navigation system, Gary eloquently illustrates the tension between avoiding driver overload but, at the same time, avoiding underload; the latter has ethical implications in terms of drivers’ over reliance (and propensity to blindly follow the guidance of a navigation system irrespective of its accuracy) on the information provided by a navigation system as well as drivers’ over reliance on such systems to the extent that they are becoming increasingly less able to form useful cognitive maps – an inability that negatively impacts drivers’ navigational ability, their flexibility in navigational behavior, and their social responsibility. Gary suggests that, to date, the styles of user interface (for navigation systems) recommended by the research community have actually “exacerbated” problems of driver safety and traffic efficiency; he therefore strongly encourages us to undertake novel studies in this research space.

The final paper – entitled “Paper Rejected (p>0.05): An Introduction to the Debate on Appropriateness of Null-Hypothesis Testing” – by Mark Dunlop and Mark Baillie serves as a timely cautionary and thought-provoking caveat to researchers motivated to make a dent both in the topics already highlighted as well as the myriad other research avenues of mobile HCI as a discipline. Deliberately controversial,
this paper introduces the mobile HCI community to the ongoing discussion on the perceived limitations of p-based null-hypothesis statistical testing – a practice which has been seriously criticized in other domains, some going so far as to advocating a ban on the use of such techniques. Mark and Mark introduce the key problems associated with the reliance on such statistical methods, reflecting on the severity of the problem within our own discipline – i.e., the extent to which we are “statistical sinners”. They provide some suggested solutions, but principally encourage researchers and reviewers alike to read the deliberately short, and therefore manageable, bibliography presented in the paper.

As I am sure readers will agree, these position papers are, in their treatment of the varied yet related subject matter, thought provoking, stimulating, encouraging, and best of all, demonstrative of the passion and dedication of the journal’s advisors. As I said previously, I hope that these articles act as motivating catalysts to encourage you to further explore your existing fields of research with renewed vigor and/or different perspectives, to let your imagination lead you to new and exciting possibilities for interaction with mobile technologies, and to reflect on how you can best consider the ethical ramifications of what we, as a discipline, deliver, and then to act upon these considerations.

The articles presented in the inaugural volume of the International Journal of Mobile Human Computer Interaction highlight just some of the diverse aspects of mobile human-computer interaction design, evaluation, and acceptance that challenge us as we look to the future. I sincerely hope that researchers, academics, and practitioners alike will benefit from, and be challenged by, the high quality research and practice reflected in these articles.

**Advances, Challenges, and Blue-Sky Thinking**

In preparing this introductory chapter, I wanted to reflect on the most significant advances in recent times across the discipline of mobile HCI, to identify the current and future challenges faced by the field, and to reflect on some blue-sky thinking in terms of where the field might go in the coming months or years. Given the broad range of research areas encompassed by the mobile HCI ‘label’ I thought where better to gather such ideas than from the esteemed experts who make up the advisory team of the IJMHCI. Hence, I asked the team to reflect on the three aspects noted above within their respective areas of expertise and the following discussion reflects their responses.

Opening the discussion with a high level of reflection, Russell Beale, who leads the Advanced Interaction Group at Birmingham University, UK, suggests that “widespread adoption of highly interactive technologies...[the fact that] mobile phones are widespread and offer texting and simple communications facilities to millions, especially in the developing world” together with the added advantage that “iPhones/Androids give access to intuitive gestural interactions” are perhaps the most significant advancements within the field of mobile HCI in recent times. He sees current and future challenges in terms of fully “understanding how people’s fundamental needs are affected and supported by the developments in technologies” and can imagine a world in which there is “increased obscuring of the computer in the interaction cycle, increased awareness of distributed cognition artifacts and designing for them, and revised design methodologies to support more general and wider-stakeholder systems”.

When asked his opinion of the most significant advances of recent times, Jesper Kjeldskov, Associate Professor in the Department of Computer Science at Aalborg University, Denmark responded: “The iPhone. It represents the first mobile device that provides a pleasurable mobile user experience. It’s the mobile device we have been envisioning for a decade, and its uptake confirms that we were right about what people would want to do with mobile technology if we could just provide them with a device (and
application infrastructure) that was good enough”. Jesper notes that the current and future challenges include “context-centred mobile interaction design – designing mobile applications that are truly useful and that fit the diverse aspects of human life. A major challenge for future research is to “cast the net” wider than traditionally done within user-centred design and focus more specifically on context”. Finally, in terms of blue-sky thinking, Jesper identifies as pivotal “representational context-awareness – systems that present context information for the user to act on rather than trying to adapt to it – a sort of response to the somewhat failed project of context-awareness. Using context information and machine intelligence to automatically make interfaces provide the information that users need in any given context has proven extremely difficult. In response, I suggest that context-aware systems are used to represent context information to its users rather than adapting to it automatically: making use of human intelligence instead”.

Related to the above, and focusing on the topic of interactive migratory user interfaces, Research Director and Head of the Human Interfaces in Information Systems Lab at CNR, Italy, Fabio Paternò comments that “nowadays people are ever more exposed to ubiquitous environments, which are characterized by the availability of various interactive devices with different interaction resources. Thus, the possibility to opportunistically exploit the resources that such contexts offer (e.g., moving from stationary to mobile devices) is invaluable for providing an effective interaction experience to the user. In this context, interactive migratory user interfaces offer the added value of enabling users to migrate across various types of devices while preserving the task continuity. Various types of migration can be identified depending on the number of source and target devices or whether the entire user interface or only a part of it migrates. In particular, partial migration concerns moving only a portion of the interactive application to another device in order to better support a mobile user”. In terms of blue-sky thinking, Fabio suggests that “we can expect in the near future to have migration involving types of devices/modalities other than desktop and mobile devices. Another interesting evolution is in the area of end-user development because this approach allows fast prototyping of mobile applications starting from existing desktop applications in a way feasible even for people without programming knowledge”.

Mark Dunlop – Senior Lecturer at Strathclyde University, UK – discusses the advances and challenges faced in the realm of mobile text entry: “the widespread move to full screen touch interface phones has been liberating in many areas but perhaps most so for text entry which has been seriously constrained by both the physical keyboard layout and text entry patents. While most touchscreen phones use ye-olde QWERTY keyboard transposed to a touchscreen, the widescreen adoption has sparked a wide range of alternatives, both in research labs and as third-party applications. Alternative layouts have been predicted to give higher entry rates, e.g. the unambiguous Fitaly layout for stylus-based PDAs and the ambiguous JustType keyboard layout. As well as redesigning the layout, we could also exploit technologies such as pressure sensitive screens. Currently there is a flurry of developer activity trying to produce alternative keyboards and input methods on touchscreens – the research community has to analyze these alternatives, attempt to find consistent lessons, and understand how people enter text on mobiles – for example, does it differ when walking and sitting while texting or emailing? Out of this should emerge both new alternative technologies and a deeper understanding of how we can best interact with small phones. Certainly an exciting time compared to the constrained recent history of mobile phone keypads”.

Picking up on the topic of her position paper, Janet Read, Director of the Child Computer Interaction (ChiCI) Group at the University of Central Lancashire, UK, notes that “in the field of design and evaluation of mobile technologies for children, the landscape is continuously changing. Each generation, or even micro generation (5 years) seems to adopt a new technology of choice and as fast as the
technologies and generations change, so does the usage”. Janet reflects that “it is often the children that go outside the box and create new ways to interact and use technologies. As we move into the next few years, the generation of children as smart phone users will no doubt challenge many of our adult assumptions about use, about privacy and about ownership of data. It is highly likely that children will find new ways to use their mobile devices to communicate, to express themselves and to locate products and services”. In terms of blue-sky thinking, Janet suggests that “mobile technology for children will not necessarily be constrained to traditional mobile phone devices. The addition of projection facilities to mobile phones, the cheaper access to internet time, the reduced cost of GPS technologies and the additional services offered by technology providers will all offer new possibilities – children could be receiving and sending their homework on mobile devices while also augmenting their school bags and products with smart mobile products that will do much of their thinking!” and challenges us to “imagine a school bag that knows what has been put into it and tells the child to hurry up as he or she dawdles to school!”.

Gary Burnett is an Associate Professor in human factors at Nottingham University, UK, where his research focuses on human aspects of advanced technology within road-based vehicles. Also elaborating on the theme of his position paper, Gary notes that “vehicle manufacturers are constantly looking to utilize new mobile technologies and drivers (and passengers) increasingly bring a range of technology devices into their vehicles (e.g., mobile phones, mp3 players, etc.). Such trends are having a radical effect on the safety, efficiency and comfort of modern vehicles; hence, the minimization of overload in mobile technology design will continue to be a focus for research”. Gary reflects that research in this area has led to the refinement of “specific methods to assist designers in predicting the potential negative effects of alternative interfaces. This development has been largely technology and cost-driven, and there is an urgent need to understand what makes a ‘good’ simulator, relating to issues of validity, reliability, etc.”. Looking to the future, Gary suggests that research “will increasingly need to address issues of underload (largely relating to the affects of automation). Primary driving tasks have remained largely the same since vehicles were first developed but forecasts suggest that the future driving experience will be considerably different, as greater numbers of vehicles possess technologies that automate varying aspects of driving. There will be an important need to understand behavioral adaptation affects and the fundamental issues concerning the nature of driving ‘skill’”. Gary closes by warning that “ultimately, research in this area will need to understand the complex relationships between overload and underload conditions. Safety should always be the over-riding consideration in such research!”.

Gitte Lindgaard is Professor of Psychology at Carlton University, Canada where she holds NSERC/ Cognos Chair in User-Centred Design in Human Oriented Technology Lab (HOTLab) of which she is director. When asked about the most significant advances in mobile HCI, she notes that “much is happening in the field of disaster management, especially in the CBRNE (Chemical, Biological, Radiological, Nuclear, Explosives) area. Particular focus is on technologies supporting communication both among first responders representing different agencies, and among responders and the public. Prominent among these are various speech-based technologies including efforts to provide speech-based or EMG-based (Electromyelography) technologies for responders dressed in hazmat suits and wearing gas masks. Web technologies are also being used for instant communication purposes”. In terms of current and future challenges, Gitte reflects that “there is still so much to be done to support disaster management, be they natural disasters or terrorist attacks. Speech recognition, while advancing rapidly, is still not sufficiently well developed to be relied upon in an emergency. Cellular networks tend to be swamped, leading to consequential breakdowns; geo-spatial technologies are evolving and can be employed in certain situa-
tions, but positioning accuracy is still insufficient to support, for example, fire fighters finding their way inside burning buildings. EMG technologies, while promising, need further development, and there are probably many other possible solutions to effective and timely disaster management yet to be explored”. Finally, in terms of the future, Gitte comments that “I am sure that we are on the verge of solving many of the known issues in CBRNE management...but there is a long way to go still”.

Antti Pirhonen is a senior researcher in the University of Jyväskylä, Finland. Although he considers the most important advances of mobile HCI in recent times to be “assistive technologies. Smart phones, which enable text-based communication in mobile settings, have probably added a new dimension in the life of people with hearing impairments. It is a good example of an application which has enhanced quality of life.”, he cautions that “there are many examples of assistive technologies, though, in which human help has just been replaced with a technical solution”. Antti goes on to challenge us via his observation that “human-computer interaction, because of its history, is not a human-centric area of research in a positive sense only. The negative side-effect of the human, or user-centric, approach is what could be called “individual centeredness”. In our postmodern era, individualistic approaches are resonating with various areas of society, and with economy in particular. In the area of mobile HCI, individualism is perhaps an exceptionally salient phenomenon since applications are extremely personal. However, to be human-centric, the real challenge of the research of mobile HCI is to widen the scope of research to cover more essential issues of human life than just the details of usage of applications. To be a credible branch of science, genuinely critical views about the impact of current trends in our culture, social well-being and health, to name but a few, should be raised in mobile HCI”.

From widespread adoption of mobile technologies to effective context-awareness to migratory interfaces on such technologies, from the specifics of text input on mobile devices to their use in road-based vehicles and by children, and consideration of the use of mobile technologies in disaster management, the above discussion on the advances, challenges and blue-sky future of mobile human-computer interaction gives us much to consider. Interesting and encouraging to note is the thread of discussion permeating much of what has been presented in this introduction and throughout the articles included in this book related to the ethical and societal impact of what we do as mobile HCI researchers. We are repeatedly encouraged to be most mindful of Antti’s provocation to carefully consider the impact on our culture, social wellbeing and health of current and future research trends in our field. Readers may agree or disagree with some of the positions stated; either way, my hope is that the discussions prove stimulating and convey the energy and excitement of the past, present, and future of the field of mobile HCI.

**CLOSING COMMENTS**

The inaugural volume of the *International Journal of Mobile Human Computer Interaction* has delivered exciting research, practical guidance, and stimulating food for thought in terms of research directions and challenges across the spectrum of the mobile HCI discipline. In bringing together not only the various articles included in four issues of the inaugural volume but also reflections on advances, challenges, and blue-sky directions by some of the field’s most eminent researchers, I believe this publication serves as an invaluable compendium for researchers, educators, students, and practitioners alike.

I would like to conclude by thanking everyone who has been involved with the evolution and development of the IJMHCI – the invaluable contribution of the journal’s advisory boards and board of reviewers and, of course, the essential contribution made by the authors of published articles and guest
editors of the special issues – which has not only led to an exciting and vibrant journal, but has culminated in this comprehensive publication. All that remains now is for me to welcome you to this book which draws together all the research achievements and challenges presented in the inaugural volume of the IJHMCI as well as setting out challenges for the future of the field of mobile HCI.

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