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Research and Design Innovations for Mobile User Experience

Part of the Advances in Wireless Technologies and Telecommunication Series

Kerem Rizvanoğlu and Görkem Çetin

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Research and Design Innovations for Mobile User Experience

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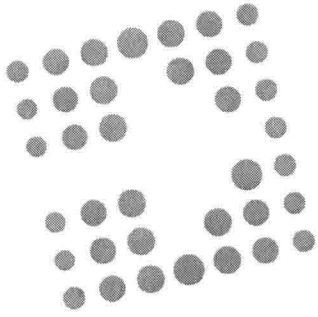

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Preface

In the last decades, "user experience" (UX) was a buzzword widely associated with a wide variety of meanings, ranging from traditional usability to beauty, hedonic, affective, or experiential aspects of technology use (Hassenzahl & Tractinsky, 2006). However, systematic exploration of the phenomenon resulted in an ample literature on UX in human-computer interaction (HCI). Similarly, mobile UX has gained momentum as a significant area of research in recent years. The emergence of mobile HCI as a separate unique field in HCI discipline with diverse academic activities and bodies of literature support this idea.

Mobile devices allow users to stay connected anytime, anywhere, and these new devices are also fun to use: gestures add a welcome feeling of activity to the otherwise joyless ones of pointing and clicking. However, diverse user groups still suffer from usability issues caused by the design of mobile interfaces and limitations of the mobile devices (Kaikkonen, 2009). Although the research on mobile user experience (UX) is an area of growing interest in the area of human-computer interaction and the mobile HCI community is trying to create and adapt research methods, tools, and infrastructure for mobile-specific challenges and opportunities (Kjeldskov & Stage, 2004), there is still a limited number of contributing studies on mobile UX which address both researchers and professionals that work in the field of mobile HCI. There are sets of human interface guidelines that are generated by major companies in the sector, but most of them ignore established conventions of interaction design developed throughout the long history of HCI research. In this context, it is evident that there is an increasing demand for solid guidelines in mobile UX design and research. Besides, educative material is also very limited for graduate students studying in Visual Communication Design, Human-Computer Interaction, and Interaction Design Departments.

Secondly, it is not so difficult to observe that the product managers in the sector of mobile communication often ignore usability issues and UX processes because of the time and budget limitations. However, when it comes to delivering innovation on mobile devices, new philosophies, research, and approaches should be taken into consideration.

By including cutting-edge empirical studies and live cases from the professional sector, it is aimed to prepare a reference book for the mobile HCI community which will reveal key mobile user experience issues with solid data and guidelines and will support innovative design and development processes. We believe that this reference book, with a comprehensive scope based on diverse issues on mobile UX design, will address an expert target audience from both the academia and professional sector.

As the editors, we have the privilege to include two original chapters written by Aaron Marcus, who is one of the pioneers and passionate contributors in the field of human-computer interaction. In these chapters, Marcus presents the detailed process and design of their two innovative mobile applications

based on information design ad persuasion theory. Both projects are self-funded by the author's firm and are still ongoing. These projects are undertaken with an intention to demonstrate the direction and process for such products and services.

In "The Driving Machine: Combining Information Design/Visualization with Persuasion Design to Change Behavior," Marcus seeks to provide an innovative vehicle dashboard that combines information design and persuasion theory to change the driver's behavior, promoting safety, fuel efficiency, and sustainability. In this context, the chapter presents the development of the application's user interface, the information design, information visualization, and persuasion design. Although the design is incomplete, AM+A is willing to share the approach and lessons learned in the interest of helping alleviate worldwide automobile safety challenges and worldwide environmental challenges.

The second chapter, "The Travel Machine: Combining Information Design/Visualization with Persuasion Design to Change Behavior" provides a unique mobile application which presents effective ways to foster a shift from leisure to cultural tourism by changing people's travel behavior in the short- and in the long-term. The main objective is to persuade and motivate people, especially travelers aged up to 50 years, those from higher to average economic and educational demographics, to open themselves up more intensely towards the local population and culture of a destination, and to make out of their trip a deeper, personally enriching, and educational experience. For this objective, a mobile phone application prototype, namely the Travel Machine, was conceived by the author's firm, combining information design/visualization and persuasion design. This chapter explains the development of the Travel Machine's user interface, information design, information visualization, and persuasion design.

In "Framework to Enhance the Mobile User Experience of Goal Orientated Interactions," Botha contributes to the existing literature on mobile user experience by the proposition of a descriptive framework, which outlines the issues and factors that should be considered when planning for a UX. In this context, she first aims to improve the concept of "Mobile User Experience" in goal-orientated interactions by identifying the components and factors that would inform this interaction. This analysis presents an extensive literature review on mobile UX, which is definitely very valuable for all the researchers in the relevant disciplines. These components contribute towards the initial development of a theoretical understanding that, through a subsequent guided exploration based on iterative "Design Research" approach, leads to coherent framework that would enable the appropriate development of services and technology for the enhancement of the "Mobile User Experience in goal-orientated interactions." We believe that the adaptation of this framework to the new domains will provide valuable contribution.

In "Research On Mobile HCI: Taken Out Of Context?," Schleicher, Westermann, Weiss, Wechsung, and Möller address the issue of context-dependency in research on mobile human computer interaction (HCI) with an emphasis on large-scale field studies. By referring to a framework based on factors relevant for "Quality of Experience (QoE)," they investigate the impact of context on user experience in three different mobile applications which are designed and developed by their own teams. Through this extensive analysis, the authors provide design recommendations for both the academics and the professionals working in the field.

We have a number of chapters based on cross-cultural mobile usability with original findings from field studies. In this context, the first study is on the mobile adoption patterns in Portugal. In "Mobile Internet in Portugal: Adoption Patterns and User Experiences," Damásio, Henriques, Teixeira-Botelho, and Dias present valuable findings from an empirical user study conducted in Portugal. The authors explore the phenomena of mobile technology dissemination and use in contemporary society by focusing

mainly on the focal drivers of adoption of this technology and on the type of online activities reinforced via m-Internet access. The chapter asserts that the nature of social interactions allowed by m-Internet is a key adoption driver and consequently social activities are integrative and relevant parts of m-Internet services. This chapter also supports the notion that the type of access has an influence on the type of activities undertaken online. In this context, the authors state that while mobile access facilitates interaction and participation, it also supports more collective-based activities as well.

In "Perception of Journalistic Content Printed on Paper and on an iPad. Case Study: *La Voz de Galicia,*" Pérez, Cantarero, and Neira investigate the perception of a traditional print newspaper and its tablet version through three axes: The level of interactivity and multimedia content that users demand from newspaper-related tablet applications; the difference in perception of the journalistic content based on whether the medium is paper or the iPad; the intent to purchase the product. The authors focus on the reading experience of users in two different media: The print version of a regional daily newspaper--*La Voz de Galicia*--and a rich PDF version of that newspaper distributed on the iPad. In this context, the study contributes to the developing digital news industry with relevant findings regarding the features of current news applications and perception of the readers for these media. The study emphasizes the need for finding new ways that will make journalism more necessary, desirable, and demandable in market terms, especially for the university students, who will make up the supposedly best-informed social group of the future.

Emerging markets provide a rich set of challenges and opportunities for mobile UX researchers and designers today. In "Experimental Research Approaches for Mobile UX in Emerging Markets," Joshi and Rath, who have strong backgrounds and experience in extensive field studies in emerging markets, present findings of original field studies designed to understand user needs in these geographies by using a more locally relevant and playful approach. Through their cases, the authors aim to inform the readers about various challenges that a researcher working in this domain might face while trying to gather and understand the user behavior and their responses; and to try to explore tailor-made methods to overcome those challenges while undertaking studies in these regions. Their study confirms that growing interest in emerging markets presents an opportunity to learn from these new user-centered research techniques and tools. Given the resource constraints of emerging markets, these tools would be highly efficient both in terms of costs and resources, which in turn will lessen the burden on the scale of investments that need to be made by industry.

In their chapter entitled "Determinants of Behavioral Intention to Mobile Banking in Arab Culture," Rashed and Santos explore users' intentions to use mobile banking through Technology Acceptance Model (TAM) in Arabic countries, namely Yemen. Their findings are mostly in line with the findings of the previous studies in the relevant literature and confirm that both perceived ease-of-use and perceived usefulness are significant factors that impact the customers' intention to use online banking. In addition to that, findings of this study also support the notion that mobile banking is accepted mostly for reasons such as saving time and efforts as well as for improving the performance in the lives of the users. It is believed that the study will provide contributions for further studies concerning the use of mobile banking in local cultures.

A major focus of the chapter "Collaborative Participation in Personalized Health through Mobile Diaries," by Arslan is to understand how to bring users to involve in their own everyday health management through mobile narratives, and new media as social platforms to incite social interaction in promoting healthier lifestyles. Her chapter experiences a focus project Locast Health Diary aims to

provide a helpful set of tools for teen's risk at obesity to record their socio-psychological environment and everyday health routines through participatory workshops and evaluate the use of health diary tools for confronting obesity problems.

Whether built-in or third party in nature, mobile applications provide the fastest growing mobile content with huge numbers of users, including the disabled ones. However, they unfortunately fail in supporting accessibility for blind users. There are solid and reliable standards concerning web accessibility on desktop environments such as "Web Content Accessibility Guidelines" (WCAG). However, mobile platforms still remain as a frontier for accessibility. There are still no guidelines generated to support mobile accessibility and the number of empirical research focusing on mobile accessibility is still limited. In this context, more information is needed to understand both usage patterns and hardware/software platforms to guide decisions to meet the needs of people with disabilities who use mobile devices. Çalışkan, Öztürk, and Rızvanoğlu, in their chapter entitled "Mobile Accessibility in Touchscreen Devices: Implications from a Pilot Study with Blind Users on iOS Applications in iPhone and iPad," provides a valuable contribution to these efforts. This pilot study provides preliminary findings on the accessibility of some selected built-in and third party applications in iPhone and iPad, which include VoiceOver as a built-in screen reader in iOS. This study supported the notion that most of the built-in and third party applications in iOS are not accessible enough to support the blind users. Most of the accessibility issues observed were common for applications in both categories and seemed in line with the findings of the studies in the relevant literature. The findings revealed significant accessibility problems caused specifically by design of the graphical user interface features of the applications and limitations of the screen reader. Finally, as part of future research directions, preliminary guidelines are proposed to improve accessibility for iOS applications in both platforms.

In "Gestural Interaction with Mobile Devices based on Magnetic Field," Yuksel introduces a revolutionary interaction framework that is based on the idea of ADI. His proposed method constitutes a touchless data entry system that is based on the interaction between the magnetic fields around a device and a properly shaped magnet. The magnetic field that surrounds the device is generated by a magnetic sensor (compass) that is embedded in the new generation of mobile phones. The user movements of the properly shaped magnet in front of the device, then, deforms the sensor's original magnetic field pattern whereby we can constitute a new means of communication between the user and the device. His experimental results show that the proposed interface not only elevates the convenience of user-device interactions, but also shows very promising accuracies in a wide range of applications requiring user interactions.

In "Trapped in My Mobility: How a Principle of 'Control over Communicative Interaction' can Guide Privacy by Design in Mobile Ecosystems," Baruh and Popescu benefit from a "control over communicative interactions" perspective to discuss the privacy implications of mobile ecosystems and argue that mobile environments create privacy-threatening "sticky" relationships that make it increasingly difficult for individuals not only to control flow of information about themselves but also flow of communication that targets them. In their chapter, they offer a set of principles, called "home mode" for mobile privacy, in implementing remedies for threats to privacy in mobile environments.

Being one of the reality-based emerging interaction styles, mobile AR is expected to be a positive move toward user experience since it will rely on existing knowledge of the world and will reduce the mental effort required to use mobile applications. In "Designing Browser-Style Augmented Reality Applications," Meawad and Ahmed discuss the principles underpinning the design of a solution for an indoor-outdoor world browser platform. Their chapter presents the results of qualitative evaluations that

were conducted on existing commercial world browsers and the design ideas of the proposed solutions. The main elements of a successful world browsing experience are highlighted as a guide for augmented reality designers.

Mobile context-aware systems focus on adapting mobile service provision to the actual user needs. They offer personalized services based on the context in which mobile users' requests have been submitted. Since contextual information changes over time, the application of established itemset change mining algorithms to context-aware data is an appealing research issue. Change itemset discovery focuses on discovering patterns which represent the temporal evolution of frequent itemsets in consecutive time periods. In his chapter "ConChi: Pattern Change Mining from Mobile Context-Aware Data," Cagliero presents ConChi, a novel context-aware system that performs change itemset mining from context-aware data with the aim of supporting mobile expert decisions. To counteract data sparseness itemset change mining is driven by an analyst-provided taxonomy which allows analyzing data correlation changes at different abstraction levels. In particular, taxonomy is exploited to represent the knowledge that becomes infrequent in certain time periods by means of high level (generalized) itemsets.

In "Using Information Retrieval for Interaction with Mobile Devices," Yuksel addresses the challenges exposed in the ubiquitous systems while defining what is to be done with the system (Norman's Gulf of Execution) and allowed users to effect a meaningful action, control its extent, and possibly specify a target or targets for their action. In his first proposal, he provides a novel methodology for augmenting conversations during daily life activities with related multimedia content by utilizing automated speech-based multimedia retrieval techniques. In his second proposal, he describes a novel search-based interaction technique that allows 3D modeling of indoor/outdoor environments using multi-view sketch input from a mobile device. In both usage scenarios, it would be difficult and time consuming for users to specify which object to bind with the action, especially concerning they might not know it in advance. This removes the problem of learning and memorizing how to express a meaningful command to a system without the necessity of choosing from limited options.

Mobile media users were found to make public spaces their own private territories. They used mobile media to bridge their personal relationships and isolate the unwanted interactions or sounds in the public. In his chapter "Public Use of Mobile Media on College Campuses," Chen used a triangulation research method to understand how mobile media were used in public between 2005 and 2009 on American college campuses. His results showed that mobile media users changed public spaces into their private spaces by the use of their mobile media. The heavier mobile media dependency students had, the more uses their mobile media in public space. This was truer for females than males in his study.

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The Travel Machine: Combining Information Design/Visualization with Persuasion Design to Change Behavior 22
Aaron Marcus, Aaron Marcus and Associates, Inc. (AM+A), USA

Travel and tourism is a booming sector of the 21st century world economy. Despite numerous positive trends, numerous critics deplore some developments in this industry. In an era of increasing leisure tourism or "part-time leisure tourism" tacked on to business trips, coming into contact with other cultures risks fading into the background. Therefore, the Travel Machine project of 2012 researched, analyzed, designed, and evaluated effective ways to foster a shift from leisure to cultural tourism by changing people's travel behavior in the short- and in the long-term. The main objective is to persuade and motivate people, especially travelers aged up to 50 years, those from higher to average economic and educational demographics, to open themselves up more intensely towards the local population and culture of a destination, and to make out of their trip a deeper, personally enriching, and educational experience. For this objective, a well-designed mobile phone application prototype, the Travel Machine, was conceived by the author's firm, combining information design/visualization and persuasion design. This chapter explains the development of the Travel Machine's user interface, information design, information visualization, and persuasion design.

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Practitioners and interaction designers cannot design, much less control, the Mobile User Experience. They can, however, design for an enhanced Mobile User Experience. This chapter aims to advance the understanding of Mobile User Experience in goal-orientated interactions by identifying the components that would inform the interaction. These identified components are underpinned by Mobile User Experience factors and the impact they will have on the interaction. Together these components and Mobile User Experience factors contribute towards the initial development of a theoretical understanding that, through a subsequent guided exploration, led to the development of a coherent framework that would enable the appropriate development of services and technology for the enhancement of the Mobile User Experience in goal orientated interactions.

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This chapter addresses the issue of context-dependency in research on mobile human computer interaction (HCI) with an emphasis on large-scale field studies. Based on a general framework that includes all the factors relevant for Quality of Experience (QoE), the authors first show how context affects basic processes on the side of the user as well the system or device. Then the authors describe three own studies where they aimed to account for context in app usage. The first tried to do so by offering an app for a very specific usage situation (commenting soccer world cup games), the second groups related applications of one domain (on-campus service for students) in an app-in-app bundle. The third example illustrates how evaluation of one single app across various contexts can be achieved in a classic field trial. Based on the authors' experiences, they provide recommendations what to consider when planning a study and finally point out future directions of research.

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In contemporary society, Internet services and phones are blending into a mobile device frequently called smartphone. As a consequence, mobile Internet is having an exponential growth and new practices of mobile social networking and mobile communication are emerging, as these devices make it easier to maintain networks of relationships. Resulting from this convergence, contemporary mobile user experience also contributes to the blending of local and global through the permanent dynamic articulation of communication and coordination. This chapter deals with the emerging adoption drivers of mobile Internet and the behaviors of use that characterized it, highlighting the importance of mobility for online activities and the industry's and user's perspective of this technology adoption, patterns of use, motivating factors, and type of activities performed online. The authors' main hypotheses argue that the nature

of social interactions allowed by m-Internet is a key adoption driver and that, as consequence, social activities are integrative and relevant parts of m-Internet service. Moreover, The authors discuss that the type of access has an influence on the type of activities undertaken online, arguing that mobile access facilitates interaction and participation and supports more collective-based activities.

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The introduction of digital tablets and the reduction in their price has meant that the newspaper publishing market has had to adapt itself to a new medium with a heretofore unseen different concept of design and use that is a hybrid between print content and a Web page. The aim of this comparative study is to investigate the reading experience of users in two different media: the print version of a newspaper and a rich PDF version of that newspaper distributed on the iPad. The study aims to contribute to the developing digital news industry with relevant findings regarding the features of current news applications. The study focuses on La Voz de Galicia, a regional daily newspaper with a circulation of more than one hundred thousand copies per day. In this study, we draw conclusions regarding the level of interactivity and multimedia content that the sample group demands from newspaper-related tablet applications, the difference in perception of the journalistic content based on whether the medium is paper or the iPad and the intent to purchase the product. This information is particularly relevant given that it has been obtained from future adults who within a few years will be in a context in which the trend in paid journalistic consumption will decrease while the penetration of tablets in the market will increase.

Chapter 7
Experimental Research Approaches for Mobile UX in Emerging Markets 128
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Mobile devices and services have changed the way people interact around the world, especially in the resource-constrained parts of developing countries. A growing number of professionals, students, and organizations show interest in understanding the user population in these regions to create solutions that address their needs. In this chapter, the authors aim to share and discuss their experiences and experiments designed to understand these user needs by using a more locally relevant and playful approach. The primary objective is to sensitize the readers about various challenges that a researcher working in this domain might face while trying to gather and understand the user behavior and their responses; and to try to explore tailor-made methods to overcome those challenges while undertaking studies in these regions. The authors' intent is to benefit the entire fraternity by sharing these experiences, and making them aware of the possible problems in incorporating traditional research methods in developing nations.

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