Frontiers in Accessible Interfaces for Pervasive Computing

– Proposal for a workshop at Pervasive 2012 –

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"We have a moral duty to remove the barriers to participation, and to invest sufficient funding and expertise to unlock the vast potential of people with disabilities."
Professor Stephen W. Hawking, Foreword to the first World Report on Disability, 2011
World Health Organization and The World Bank

1. Background and Motivation

Pervasive computing is a reality today for many people. The promise of computing everywhere at any time has come true with smart phones, tablets, interactive kiosks, automated services, continuous glucose monitoring systems, and even self-parking vehicles [1-5]. But pervasive computing is not everywhere for everyone. For example, many researchers focus on the significant social and economic challenges to computing literacy [6, 7]. However, pervasive computing faces another, more covert and indiscriminant set of challenges, that posed by disabilities. Most humans experience some form of temporary disability at some point in their lives. Yet, for more than one billion people worldwide, living with a disability is a permanent reality. Moreover, for nearly 200 million the disability is so severe that it impedes everyday functioning. Due to a global aging population and to a major increase in the prevalence of developmental disorders and chronic diseases, these numbers are on the rise [8].

While some pervasive computing technologies and contexts create considerable interaction challenges for everyone (e.g. texting and walking), they routinely create almost impossible obstacles for people with impairments (e.g. texting on a touch screen for blind people). Yet, the true promise of pervasive computing is to continuously empower people in everything they do. As Aimee Mullins eloquently states it, "it is not about overcoming deficiency. It is about augmentation and potential" [9]. We argue that the greatest opportunity for pervasive computing to positively impact human empowerment is to remove the barriers to participation and unlock the vast potential of the one billion people with disabilities.

Accessibility is the central topic of ACM ASSETS, but its focus is not on pervasive computing. There are many notable exceptions, which are typically spread through the conference program [10-14]. Furthermore, given its conference format, participants have little room for discussion and hands-on sharing of technology and methodology. ACM CHI presents many works centered on accessibility, but, again, the focus is not necessarily on pervasive computing interfaces, the work is spread out, and there typically is little room for discussion [15-18]. Some recent CHI workshops have addressed the challenges in accessibility but without a pervasive computing focus [19]. We believe that given the goal of perpetual empowerment, pervasive computing should be central to most accessibility work.

On the other hand, Pervasive, Ubicomp, Personal and Ubiquitous Computing, and MobileHCI regularly present research in accessibility when it is relevant to the central topic of these venues, but not as a main focus of the conference or journal [20-26]. As a result, the premier work in accessible interfaces for pervasive computing and the impact pervasive computing may naturally have on accessibility is spread across a number of venues and has not had a proper arena for open and hands-on discussion.

With this workshop, we propose to gather for the first time the world-leading researchers in pervasive computing accessibility. We plan to open a frank discussion space through short talks and demos and long design and evaluation exercises. Finally, we plan to make public the results of the workshop as a short documentary and as a journal paper.

2. Objectives

The primary objective of the workshop is to provide a venue for sharing and discussing frontier technologies and evaluation methodologies for accessible interfaces for pervasive computing. We want to encourage the workshop's participants and the community at large to discuss lessons learned from previous design successes and failures, raise methodological issues in designing special evaluations given the nature of pervasive computing and of the target user populations, and propose future research questions and challenges. The areas of discussion and the call for participation include but are not limited to the following topics.

Research in accessible interfaces is typically composed of three main phases. First, researchers aim to understand current practices and pinpoint possible tools for augmenting those practices. These field studies typically include quantitative and qualitative methods for observing and analyzing people's practices. Second, they design and build these tools, often refining the design through formative studies. The most common design practices include user-centered design, participatory design, and design patterns. Formative evaluation methodologies include controlled laboratory studies, focus groups, pilot studies, and heuristic evaluations. Finally, the most ambitious research deploys the technology in real environments with real users and tracks the short and long term usage patterns including task effectiveness and efficiency, technology appropriation, ecological integration, financial viability, and ease of learning and use. Evaluation methodologies for longitudinal deployments include ethnographic research.

Another classification of accessibility research focuses on the type of disability the technology supports. Broadly, the main research thrusts are accessibility for blindness and visual impairment, deafness, blind and deafness, motor and mobility impairments, cognitive impairments, developmental disorders, learning disorders, and psychological disorders.

Within each of these categories, the domain of pervasive computing typically focuses on a set of accessibility tasks including navigation, mobile communication, memory, cognitive and emotional support, contextual learning scaffolding, sensory translation, mobility and motor aids, and prosthetics.

Interestingly, there is also a field focused on sensing and activity recognition for capturing and understanding specific behaviors and supporting the clinical practices targeted at treating many disabilities. A number of single and multi-modal technologies exist to capture behavior through video, sound, skin temperature, accelerometry, electro-dermal activity, electroencephalograms, and cardiac rate. Pervasive computing in these cases augments the practices of the stakeholders in the lives of people with disabilities to indirectly support the person with the disability. Also, the goal is to understand the disability further in order to create better designs.

3. Format

To begin the session, we plan to invite a leading researcher or prominent person who has overcome a disability to give a keynote. Next, we aim to create a hands-on environment where all the accepted participants present, use, design, and evaluate frontier technologies that support accessible interaction for pervasive computing. Participants of the workshop will give five-minute round-robin presentations of their research with pre-delivered slide presentations, they will bring their technologies to be used and will

be ready to use other people's technologies and will engage in multiple rounds of constructive feedback on the technologies. People will bring their evaluation methodologies, their study designs, and their measurement technologies, such as logging and scripting programs. Participants will engage in small-group, hands-on design and evaluation of the technologies using other participants as pilot subjects. Finally, workshop participants will design a new technology and its evaluation methodology.

Tentative Schedule

8:30	doors open and breakfast
8:50	opening
9:00	keynote
9:45	coffee break
10:00	papers round-robin, interactive demos, and constructive critiques
12:30	working lunch catered in place – presentation of the short demos and flyers
13:30	discussion of future research directions
14:00	design exercise
14:45	coffee break
15:00	design of the evaluation exercise
15:30	evaluation exercise
16:30	plenary discussion
17:30	closing
20:00	optional dinner not included in workshop fees

We have 150 minutes for paper round-robin presentations, interactive demos, and critiques. The presentations should last no longer than 5 minutes, the demos, no longer than 5 minutes, and the critiques and replies, no longer than 5 minutes. That places a limit of 10 full papers presented during the 10 A.M. session. The papers will follow the regular conference format and limit. In order to engage the entire audience, we will also encourage but not require participants to submit a 300-word demo abstract with a stack of flyers (rather than a poster). During the lunch and coffee breaks, everyone who volunteers will have an opportunity to present their submission. People can explain their technology to the group by distributing the flyers while demoing their accepted design. People will have ample opportunity to discuss each creation throughout the design and evaluation exercises. Finally, in order to guide the design and evaluation exercises we will provide a design challenge and evaluation criteria.

Design Challenge and Evaluation Criteria

Arguably, the most pervasive computing platform is the smartphone and its primary purpose is telecommunication. Unexpectedly, recent studies suggest that text messaging among young adults outweighs voice calls by over a factor of six [27]. The participants' design challenge is to create accessible technologies for mobile text messaging (input and output) over commodity smartphones with touchscreens without adding new hardware. Different types of users with different types of motor, perceptual, visual, and hearing disabilities should be able to use the same hardware in order to keep production costs practical. The evaluation criteria include ease of use, efficacy, effectiveness, ease of learning, appropriation, simplicity, and ecological validity. We will provide prototyping materials such as storyboards and mock artifacts.

4. Soliciting Submissions

We will create a webpage announcing the workshop and distribute it to researchers in the area through lists of contacts, word-of-mouth, and social networks. We will also distribute flyers at relevant conferences during the call for papers period. We will post workshop news via a Facebook group and twitter. Finally, we will personally get contact researchers in the field to attract the best possible submissions.

5. Selecting Participants

We plan to recruit a program committee consisting of at least 10 experts in pervasive computing accessible interfaces focusing on design and evaluation. Every submission will be reviewed by at least two members of the program committee. Criteria for acceptance will be originality, technical soundness, evaluation rigor, and overall presentation. Furthermore, we are especially looking for creative new approaches and applications. Thus, accepted papers can also describe work-in-progress or even speculative ideas if they are presented in a convincing way, have a high likelihood of creating interesting discussions during the workshop, or contain potential of substantial impact to the field.

6. Organizers

The eight organizers of the workshop are active researchers in the field of accessible interfaces for mobile and pervasive computing. They possess extensive expertise in the design and evaluation of accessible interfaces.

Mario Romero
Dr. Mario Romero is a Fulbright Scholar and a Postdoctoral Fellow at the School of Interactive Computing, Georgia Institute of Technology. His research areas are information visualization and ubiquitous computing with an emphasis on applications for understanding and supporting disabilities. He earned his Ph.D. in Computer Science from Georgia Institute of Technology, his Master in Computer Science from University of Illinois at Urbana-Champaing, and two undergraduate degrees in Industrial Engineering and Construction Engineering from Universidad San Francisco de Quito, Ecuador.

Jeffrey P. Bigham
Dr. Jeffrey P. Bigham is an assistant professor at the Department of Computer Science, University of Rochester. His research interests include human-computer interaction (HCI), accessible computing, real-time human computation, crowdsourcing, intelligent user interfaces, cloud computing, artificial intelligence, and natural language processing. Much of his work improves access to computing for people with disabilities. He earned his Ph.D. and M.Sc. in Computer Science and Engineering from the University of Washington, and his B.S.E in Computer Science from Princeton University. In 2009, the MIT Review named him a Top 35 innovator under 35.

Tiago Guerreiro
Tiago Guerreiro is pursuing a PhD degree in Information Systems & Computer Engineering at Instituto Superior Técnico (IST), Technical University of Lisbon (UTL), advised by Prof. Daniel Gonçalves and co-advised by Prof. Joaquim Jorge. He holds BSc and MSc degrees from IST, UTL. He is a researcher at INESC-ID in the Visualization and Intelligent Multimodal Interfaces Group and an invited assistant

professor at the University of Lisbon. Tiago's main research area is mobile accessibility, focusing on improving access to mobile devices by blind users. In this and other HCI areas, he has published 70+ peer-reviewed papers, more than half in international journals and international conference proceedings.

Shaun Kane
Dr. Shaun K. Kane is assistant professor of human-centered computing at the University of Maryland, Baltimore County. His research explores the creation of new accessible input and interaction techniques for PCs, mobile devices, and wearable computers. He received his Ph.D. from The Information School at the University of Washington in 2011.

Votis Konstantinos
Dr. Votis Konstantinos is a Postdoctoral Research Associate at Informaticsand Telematics Institute/ Centre for Research and Technology Hellas. He received a Ph.D. degree in computer science from Computer Engineering and Informatics department, University of Patras, Greece. He has been working in the field of Universal design and eAccessibility, and is also participating in European standardisation initiatives and working groups concerning accessibility evaluation. Since 2001, he has been involved in several R&D projects related to semantic Web, ontologies and SoA technologies as well as in the accessible and interoperable ICT technology (COG, KWFGRID, ACCESSIBLE, VERITAS, ATIS4ALL, APSIS4ALL, CLOUD4ALL, CLEAR). He was also a technical expert of the monitoring eAccessbility study in Europe 2008-2010. He has authored numerous publications for international journals and international conferences and events.

Sergio Mascetti
Dr. Sergio Mascetti received his PhD in Computer Science from the University of Milan in 2008. Since 2007 he is Assistant Professor at the Department of Information and Communication in the same university. His research interests involve data management for mobile devices, with particular attention to the problems of privacy preservation in location-based services and to assistive technologies for mobile devices. In 2011 he co-founded EveryWare Technologies, a university spin-off aimed at developing privacy-preserving mobile services and assistive applications for visually impaired users.

Caleb Southern
Caleb Southern is a Ph.D. student in Human-Centered Computing at the Georgia Institute of Technology. His primary research involves eyes-free text entry on touch interfaces, including smartphones and tablets, with applications as an assistive technology for the visually impaired. Caleb received a B.S. with Honors in Computer Science from the University of North Carolina at Chapel Hill, and has a diverse background in industry including the fields of music production and urban planning.

Gottfried Zimmermann
Dr. Gottfried Zimmermann is professor of mobile user interaction at the Stuttgart Media University, Germany, focusing on IT usability and accessibility. He received a Ph.D. degree in computer science from the University of Stuttgart, Germany, in 1999. In 2000, he joined the Trace Center of the University of Wisconsin-Madison, USA, where he focused on research and development in the area of Universal Design in current and next-generation information and communication technologies. In 2003, he founded Access Technologies Group, a consulting company for ICT accessibility, and was the technical coordinator of the European i2home project from 2006-2009. From 2009-2011, he was junior professor of Media Informatics at the University of Tübingen, Germany.

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