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Haptic and Audio Interaction Design

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Preface

Overview

The 2nd International Workshop on Haptic and Audio Interaction Design was held in November 2007 in Seoul, Korea and followed a successful first workshop in Glasgow, UK in 2006. The 2007 event was sponsored by the Korean Ministry of Information and Communication, the Korean Institute of Next-Generation Computing, and the Association of Next-Generation Computing Industry. We remain grateful to these institutions and the generous support they extended towards us. The main focus of the HAID workshop series is to draw together researchers around the theme of human – computer interaction using the modalities of sound and touch. It addresses questions such as how to combine sound and touch interaction together most effectively. Or, are there situations in which one modality offers benefits over the other? Are there situations in which sound and touch offer unique benefits, or alternatively, in which they are inappropriate? Which design formalisms and frameworks can specifically benefit researchers considering multi-modal interfaces?

A total of 12 papers were accepted to HAID 2007, each containing novel work on these human-centric topics. Each paper was reviewed by a panel of experts composed of leading figures from both industry and academia. We extend our thanks to all our reviewers, without whom the workshop could not take place. Their diligent efforts and constructive criticisms enriched the quality of the papers considerably. Two invited submissions from our keynote speakers are also included in the proceedings. We were pleased to receive a full paper from James A. Ballas of the US Naval Research Laboratory and an extended abstract from Dong-Soo Kwon, who directs the Human – Robot Interaction Research Centre at the Korea Advanced Institute of Science and Technology. Dr Ballas presented an informative discussion about the links between the most intimate of sensory cues: the sounds and feelings produced by our own bodies. Professor Kwon provided an overview of the history of haptics research and speculated about its future, in particular highlighting how touch might be deployed in mobile devices.

The main track of papers covered considerable thematic ground, from design guidelines to technical implementations; this is an area which is developing on many fronts simultaneously. However, one trend which stands out is the focus on interaction with computational systems, but not computers. Mobile interaction and wearable displays feature prominently, as do tasks such as communication and real-world navigation. This suggests that the future of haptic and audio interactions may well be away from the desktop and out and about on streets and in homes. As computers disappear into the fabric of our living environments, it may well be that we increasingly rely on our senses of hearing and touch to command, control, and understand them. Indeed, there is a sense of inevitability

to this. In a pervasive vision of the future, surrounded by a plethora of unseen devices, we must surely rely on our other senses for interaction.

We provide an overview of the topics and foci of the papers below.

Tactile Displays

Research on tactile displays has been developing rapidly, in part because of their wide deployment in mobile phones and other handheld devices. In many cases, the underlying technology is simple and cheap and there is a general feeling that it could be put to many more constructive uses than simply indicating the arrival of a call. One key way to achieve this is through using multiple tactile actuators, an approach adopted by all the authors in this session. Lee et al. describe a wearable system which displays tactile cues directly derived from the environment to a user's fingertip, allowing them to feel at a distance. Hoggan et al. discuss a system based on mounting multiple tactile actuators to the exterior of a PDA and relate several experiments determining whether its users can effectively discriminate from which ones stimuli originate. Finally, Kyung et al. describe a new design for a miniature tactile display which can stimulate the fingertip and several studies of its effectiveness in fundamental tasks such as texture and shape perception.

Communication and Games

Haptics and audio are indivisibly linked with communication and entertainment, and this session explores new ways to express this synergy. Seeking to add expressivity and richness to mobile communications, Brown and Williamson describe the design of a novel method of sending short messages based on gestural input and tactile and audio output. At the other end of the project lifecycle, Baurley et al. discuss the situated qualitative evaluation of a wearable computing system which can convey interpersonal gestures such as hugs and strokes to the forearm. Kim and Kim describe a racing game, intended for use on mobile phones, which incorporates tactile cues to overcome the fundamental restrictions of small screen sizes. Can haptics and audio cues effectively convey emotions and create immersion and presence? The papers in this session address this demanding question.

Accessibility and Navigation

Access technologies intended to support visually impaired users remain a key domain for haptic and audio interaction design: these users rely on non-visual feedback for everything they do. Consequently, they require efficient and effective interactive systems. Two papers in this session contribute to this body of research. Shin and Lim describe a wearable computing system which integrates range-finding sensors, body tracking and vibrotactile and audio displays to enable visually impaired users to navigate safely in their immediate environment, avoiding potential obstacles. Pielot et al. support the other stage of this

process: route planning, rather than on-the-spot navigation. They describe a tangible interface which allows visually impaired users to explore an audio map, learning the locations of key landmarks by referencing the sounds they make. Kim and Kwon discuss a slightly different topic, namely, how haptic and audio cues can aid users in the complex task of accurately navigating around a three-dimensional virtual environment which is displayed on a flat, two-dimensional screen. As three-dimensional interfaces become more commonplace, this is a problem which will only become more widespread, and Kim and Kwon's work suggests multi-modal interaction may be one way to address it.

Design

As human – computer interaction matures as a discipline, the role of design is becoming more and more important. As it lacks a basis in widely applicable theories which yield consistent and predictable results, more informal structures have come to the fore: methodologies, guidelines, and principles. The papers in this session contribute to this practical, hands-on body of work. Bjelland and Tangeland discuss how the use of early-stage haptic prototypes might benefit a user-centered design process and present a case study of this in action. They conclude with recommendations for best practices to adopt while prototyping haptic interfaces. Oakley and Park discuss how to best design for eyes-free interaction, referring to systems which enable simple, rapid, and confident input without occupying visual attention. They review the literature, present a set of design principles, and describe a case study embodying these. Finally, Pirhonen et al. present a design methodology for creating rich, detailed, and effective audio interfaces. Based on detailed use scenarios and personas, the technique espouses iterative presentation of audio interfaces to panels of designers to generate consistent and refined feedback schemes. As with the other papers in this session, they conclude with a detailed case study illustrating their technique.

User interfaces remain predominantly visual, but these papers show there are many specific scenarios, and indeed much to gain, by incorporating haptic and audio elements. Our environment is composed of not only sights, but also a vibrant range of sounds, touches, smells, and tastes. HAID 2007 presented research motivated to making our interactions with computational systems equally rich.

November 2007

Ian Oakley
Stephen Brewster

Organization

The 2nd International Workshop on Haptic and Audio Interaction Design was organized by the Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea and the University of Glasgow, UK.

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