Mind the Gap: A SIG on Bridging the Gap in Research on Body Sensing, Body Perception and Multisensory Feedback

Aneesha Singh
University College London, UK
a.singh@cs.ucl.ac.uk

Ana Tajadura-Jiménez
Universidad Loyola Andalucía, ES / University College London, UK. atajadura@uloyola.es

Nadia Bianchi-Berthouze
University College London, UK
n.berthouze@ucl.ac.uk

Nic Marquardt
University College London, UK
n.marquardt@ucl.ac.uk

Monica Tentori
CICESE, MX
mtentori@cicese.mx

Roberto Bresin
KTH Royal Institute of Technology, SE, roberto@kth.se

Dana Kulic
University of Waterloo, CA
dana.kulic@uwaterloo.ca

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Abstract
People's perceptions of their own body's appearance, capabilities and position are constantly updated through sensory cues [10,14] that are naturally produced by their actions. Increasingly cheap and ubiquitous sensing technology is being used with multisensory feedback in multiple HCI areas of sports, health, rehabilitation, psychology, neuroscience, arts and games to alter or enhance sensory cues to achieve many ends such as enhanced body perception and body awareness. However, the focus and aims differ between areas. Designing more effective and efficient multisensory feedback requires an attempt to bridge the gap between these worlds. This interactive SIG with minute madness technology presentations, expert sessions, and multidisciplinary discussions will: (i) bring together HCI researchers from different areas, (ii) discuss tools, methods and frameworks, and (iii) form a multidisciplinary community to build synergies for further collaboration.

Author Keywords
Wellbeing; health; rehabilitation; multisensory feedback; emotion; positive body perception; wearables, exergames; ubiquitous; body representation.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

Body-sensing technologies are becoming more affordable and convenient, enabling their use in wearable and ubiquitous applications. Researchers are increasingly using these technologies to design novel multisensory real-time feedback to enhance people's perceptions of their own body and its capabilities [3,7], or to provide a more engaging experience of one's own body [5,16,18]. Using evidence from neuroscience and psychology that body perception is continuously updated by the multisensory feedback we receive [10], artists have been exploring embodied experiences through artistic applications of such technology [6,21]. However, similar principles are still sparsely applied in other HCI research. Multisensory feedback is being used in HCI areas such as games, sports, health and fitness for different aims. For example, within the HCI games community body-sensing technology and sensory feedback are used to enhance user engagement and presence. However, the emotional and cognitive impact of using such feedback has not been fully exploited yet, except for a few recent examples (e.g. 9,4). HCI sports applications use visual, auditory and haptic feedback to facilitate learning movement but do not explore the effect that this feedback may have on the perception of one's own body and its capabilities [15,20]. Most health and fitness applications exploit multisensory feedback to augment sensory perception and provide information to transform a generally frustrating experience (e.g. physical rehabilitation) into a more rewarding one [11]. The feedback design mainly focuses on information about physical capabilities rather than addressing body perception and emotional barriers to activity.

Of relevance to all the above HCI areas, recent work has been conducted to support more positive body perception to facilitate everyday function and/or foster coping capabilities [17], restore distorted body perceptions (e.g. body shape or size) and body capabilities (e.g. movement fluidity, strength, extent of stretch), compensate and substitute for missing sensory inputs, or even trick the brain to create the sensation of having a different and "better" body [8,10,14,18]. Different modalities, including sound feedback (e.g. 18) and haptic and visual bodily feedback (e.g. 7), have been used during physical activity to enhance/alter body perception and performance. These investigations are important given the growing body of HCI research that engages with sensitive and emotionally challenging contexts in health such as autism [19], chronic pain [17], dementia [13], aging [12], eating disorders [1], Parkinson's [3] and other conditions.

While this body of work demonstrates the opportunities offered by sensing and feedback technology explored by each community, it also raises the need to learn from each other and to develop joint frameworks for designers to maximise and efficiently use embodied mechanisms for sensory-feedback. Simultaneously, HCI research provides an opportunity for evaluating and even furthering our understanding of these mechanisms. Hence, there would be a reciprocal benefit if these different areas of research join forces. This SIG aims to fill that gap by providing a much-needed space to create synergies in the vibrant but segregated CHI community using multisensory feedback related to body sensing and body perception.

SIG aims and deliverables

Through this SIG, we aim to build a community of researchers, designers and practitioners with expertise in investigating body sensing and multisensory feedback mechanisms for body perception and in using these

mechanisms in applications across HCI. This session will enable networking, new collaborations and potentially novel ways of exploiting such research from the perspective of different domains. Researchers will share knowledge and insights into methods and tools by discussing questions of interest, such as:

1. *Sensing the body: why, what, when, how?* What should be sensed, what feedback is effective, what should it model? Is it different for different areas?
2. *Finding common ground for sensory feedback:* How to, and who, should design the feedback? How do users incorporate/use such feedback? How can we share appropriate approaches? Should feedback evolve over time and based on which principles?
3. *Body sensing approaches for self and others:* Is it helpful to share information about one's body and emotions? How is this being used?
4. *Opportunities and challenges for body sensing technology. Ethical issues*: What are the potential issues that arise when doing such research? What kind and level of support needs to be in place?

We will discuss the topics in an interactive format through provocative minute madness sessions, 4 talks by experts in the SIG topics, and a panel discussion.

Organisers and Audience

The SIG is organised by Aneesha Singh (researching multisensory feedback for chronic pain reactivation), Ana Tajadura-Jiménez (a research fellow investigating sensory alterations of body perception), Nadia Bianchi-Berthouze (a professor in affective computing exploring the modulating effect of proprioceptive feedback), Nicolai Marquardt (a lecturer in physical computing working in ubiquitous computing and physical user interfaces), Monica Tentori (an associate professor exploring the development of exergames for motor development), Roberto Bresin (a professor, expert in sonification, emotion, and expressive music performance) and Dana Kulic (a professor in engineering, exploring feedback in rehabilitation). Between them, the organisers have experience as members of conference program committees, in workshop organisation, as well as extensive publication histories in top-tier conferences (e.g. CHI), journals (e.g. HCI, TOCHI, TAC), books and special issues. The organising team truly represents the multidisciplinary and international nature of the SIG.

Goals and Outcome

The SIG will lay common ground for the research and design of multisensory feedback and foster a community of researchers working on such technology across HCI. Besides this, we expect to:

- explore the research areas in relation to existing theories, methods, and technologies (e.g. to set criteria for "good" frameworks for embodiment to guide sensory-feedback design);
- map the space of design problems and promising solutions relevant to research and practice; and
- identify challenges, and strategies to approach them, when studying and designing such systems (e.g. ethics, mechanisms, tricking and alteration).

After the SIG meeting, we will continue to build a multidisciplinary network for studying and designing multisensory feedback technology (e.g. build an email list, dedicate a website to the community, start a group on facebook, organise regular workshops, publish special journal issues, and promote grant/project collaborations). We anticipate that the fostered communication and collaboration among researchers will promote more awareness of research and practice from different domains, leading to a more comprehensive understanding of design and evaluation of multisensory technologies.

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