Introduction to the Special Issue on the Theory and Practice of Embodied Interaction in HCI and Interaction Design

PAUL MARSHALL, University College London
ALISSA ANTLE, Simon Fraser University
ELISE VAN DEN HOVEN, University of Technology, Sydney and Eindhoven University of Technology
YVONNE ROGERS, University College London

Theories of embodiment focus on how practical engagement and the structure of the body shape perception, experience, and cognition. They typically reject a view of human cognition as grounded in abstract information processing. The concept of embodied interaction is increasingly used in the design, analysis, and evaluation of interactions with and around technology. However, many questions remain as to exactly what embodied interaction means and whether it can be considered a coherent program of research. The aim of this special issue is to critically explore different perspectives on embodied interaction in HCI and interaction design research and practice and to focus on what theoretical traction they can provide.

The special issue was put together following a workshop that was held at CHI 2011 [Antle et al. 2011] where 40 participants discussed how the concept of embodied interaction has been applied and developed in the decade since the publication of Dourish's *Where the Action Is* [Dourish 2001]. *Where the Action Is* introduced the idea that embodiment should be seen as a foundational concept for HCI. It drew upon and expanded ideas from phenomenology first introduced into HCI through the work of both Winograd and Flores [1986] and Suchman [1987]. Embodied interaction is typically contrasted with cognitivist approaches that prioritize a model of thinking as information processing of abstract internal representations. Embodied interaction focuses on "everyday, mundane experience" [Dourish 2001, pp 125] and the ways that actors understand the world through the accomplishment of practical activities. However, more recent work in cognitive science has also developed theories of embodied cognition that can be underpinned by cognitive representations of a different sort: less abstract and less brain-based and more embodied, embedded, extended, or enactive (e.g., Wheeler [2005]; Antle et al. [2009]; Hurtienne [2011]).

The opportunities to support embodied interaction have expanded significantly in recent years with the development of a range of technologies designed to sense movements of the body and the continued development of ubiquitous computing infrastructures that can gather or represent contextual data. There has also been a surge of interest in embodiment in HCI. However, with this explosion has come a sometimes bewildering variety of terms such as "embodied conduct," "embodied cognition," "whole body interaction," "tangible interaction," "embodied conceptual metaphors," "third wave HCI," and

"somatics." Problems with definitions are not unique to HCI - researchers in cognitive science, for example, have identified at least 12 different meanings of "embodiment" [Rohrer 2007]. The articles in this special issue develop new perspectives on embodied interaction that contribute to clarifying the concept.

The articles offer a diverse set of perspectives on embodied interaction, though it is still unclear whether embodied interaction can be considered to be a single concept in HCI or whether it represents a number of distinct perspectives. Authors variously reflect on the design possibilities afforded by whole body interaction; develop threads of phenomenological theory that have been underused in HCI; provide critiques of existing technology-driven work in embodied interaction; detail the interactions through which bodily conduct derives its meaning in context; create a haptic augmentation system to enable the blind to perceive pointing gestures; and develop cognitive science theory that engages with the embodied, embedded, and extended character of cognition. The work on embodied cognition in particular has responded to critiques of cognitive science, but has followed a quite different trajectory to much phenomenology-inspired work on embodied interaction in HCI.

In the first article, Dourish reflects on the writing of *Where the Action Is* and the reception of his book over the last decade. He discusses why the role of the body was not a main theme in the book and how this has been taken up in related work. He reflects on how the notion of embodiment has led to new connections with work in media arts. He also questions whether *tangible computing* rather than the more general term *ubiquitous computing* was an appropriate focus in the book and discusses how he considered the chapter on design to be the weakest in the book. However, like a good wine, it can be argued that, while it was challenging to consume while still young, this chapter has aged better than if it had made more prescriptive suggestions.

Kirsh discusses how tools change the ways in which we are able to perceive and cognize the environment in terms of opportunities for action. He analyzes how dancers and a choreographer use their own bodies as tools to think with, using them as models to support cognition, and, in doing so, opens up the "magical future" of a new agenda for HCI.

Quek and Oliviera present a program of research in which a haptic glove interface was developed to enable blind and severely visually impaired students to follow teachers' gestures towards instructional materials. The system was studied in a school, with advantages described for the students, their teachers, and sighted students in the same classrooms.

Extending from Norman's [2010] discussion of what is natural about natural user interfaces, O'Hara, Harper, Mentis, Sellen and Taylor critique what they identify as a representational sense of naturalness inherent in recent discussions about gestural interactions and in the term "Natural User Interface" (NUI). They relate this sense to Merleau-Ponty's description of the objective body, going on to argue for the necessity of a focus on the lived experience of embodied actors who make gestures meaningful through their interaction with one another and their material surroundings.

Luff, Jirotka, Heath, Eden, Yamashita and Kuzuoka focus their work on the analysis of both everyday embodied interaction and technology-mediated communication. They present an analysis of discussions occurring within a T-Room: a prototype 'blended space' that aims to provide referential coherence between talk and visual conduct during discussions between remote participants. They argue that work on embodiment that focuses primarily on the body is insufficient, as the environment in which the body is embedded is of equal importance.

Loke and Robertson and Svanaes both focus their work on the role of the body in experience and the design of technology. Loke and Robertson take as their starting point work that has explored the role of movement in perception and experience. They

describe a methodology called "Moving and Making Strange" that can be used in designing and evaluating movement-based interactions with technology. The framework draws on first-person approaches to studying movement, but also includes the perspectives of the human and machine observers of movement.

Svanaes discusses two aspects of Merleau-Ponty's phenomenology of perception: *embodied perception*, which refers to the active perceiving body, including it's ability to reconfigure through the use of technology and *kinaesthetic creativity*, the body's ability to engage directly with the feel dimension of interactive products during design.

Each article in this special issue manifests a different and critical perspective on embodied interaction, which results in a body of work that is by no means comprehensive, ranging from down-to-earth interpretations to more philosophical ones. We hope this richness apparently embedded in the term embodied interaction may provide inspiration for future research.

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