Chapter 10

Conclusions and Future Work

> We can begin any exploration from a conceptual framework and discover its inherent origins through creative awakening. Or conversely, we can begin any exploration from the roots of our unknowing and discover the pattern as it manifests in expressed form. It is the dialogue and weave between the two that creates the full fabric of our individual, creative, and cognizant self.
>
> Bonnie Bainbridge Cohen (1993, p.13)

This chapter summarises the results of the thesis in relation to the research questions. It also offers suggestions for future work and the extension of the design methodology of Moving and Making Strange to other kinds of interactive technologies and to phenomenologically-inspired and ethnographically-inspired approaches to technology design.

The wider implications of design for the kinds of lives we lead and the experiences made possible by engaging with interactive technologies, are at the heart of my thesis. Prioritising the lived, experiential moving body and understanding human movement as not just purely functional, but a source of qualitative, aesthetic (or even transcendental) experience, require that we look more closely at the relations between interactive technologies and the kinds of movement-related experiences and interactions they make possible.

The design methodology of Moving and Making Strange, developed in this thesis, offers an approach to the design of movement-based interactive technologies which recognises this intimate relationship between the technologies we develop and the qualities of human experience engendered. It enables a specific focus on movement and its felt experience, which can then inform the design of new movement-based systems and ensure the accountability of future systems to the lived experience of potential users of technology.

10.1 Research questions revisited

Within the context of movement-based interaction design, the research questions explored in this thesis were:

1. What understandings of human movement are relevant?
2. How and in what ways can the experiential nature of the moving body be accessed and understood?
3. How and in what ways can the moving body be described and represented?

Each question is addressed in turn, in the following sections.

10.1.1 Question 1: What understandings of human movement are relevant?

In regard to the first question, ways of understanding human movement for use in the discourse and practice of movement-based interaction design

were sourced from other disciplines with a focus on movement, in particular, dance, somatics, physiotherapy, anthropology and phenomenology. Five conceptions of movement were drawn from the literature to provide a multiplicity of perspectives for designers working with the moving body as input to interactive, immersive spaces and other movement-based interactive technologies. The manifold perspectives on movement include movement as anatomical, mechanical function, movement as perception, movement as expression and transformation, movement as felt, kinaesthetic experience and movement as a communicative act. This set was chosen specifically to support the proposed design methodology with its emphasis on understanding movement from both the first-person experiential and the observational perspectives. The first-person experiential perspective deals primarily with movement as anatomical, mechanical function, movement as perception and movement as felt, kinaesthetic experience. The observational perspective deals primarily with movement as anatomical, mechanical function, movement as expression and movement as a communicative act. The five different, yet complementary, conceptions of movement enable designers to understand the moving body in interaction with machines and other people within various contextual frames, ranging from the individual performance and perception of movement to the social and cultural.

I worked with different kinds of movements in each of the three projects. The movements examined for potential input to interactive technologies included physical actions in the context of single user game-play, the patterns of movement and stillness of multiple users in social contexts and heightened and choreographed forms of movement, including the act of falling, within a hypothetical interactive space for public performance. The range of movements covered enabled a focus on the relations between the performance and experience of different aspects of movement treated as input and machine interpretations of the input.

10.1.2 Question 2: How and in what ways can the experiential nature of the moving body be accessed and understood?

In regard to the second question, the experiential nature of the moving body can be accessed and understood through first-person perspectives and methods that focus on the attention to, and articulation of, the sensing, feeling and moving body and the felt experience of movement. This was initially explored in the second project, Bystander through the use of experiential methods of design reflection-in-action (Schön, 1983), such as enactment and physical immersion. These experiential methods enabled the designers to experience first-hand the movements and felt experience of potential users of interactive technologies and to ground their understandings of the design in the actual movements arising from interaction with specific interactive technologies. Movement-oriented personas and scenarios were developed and used in this thesis to orient designers to the user experience and to provide structure for scenario enactment.

This question was further explored in the third project, Falling into Dance by working with trained dancers and physical performers. Methods and techniques were identified from dance and movement improvisation practices as potential tools for designers to access the experiential nature of the moving body and to make strange with the moving body. These methods and techniques then formed a critical part of the design methodology of Moving and Making Strange. The application of these methods and techniques will provide designers with a vibrant ground for working with movement in the design process and for finding new ways to use movement as input to interactive technologies.

10.1.3 Question 3: How and in what ways can the moving body be described and represented?

In regard to the third question, a continual thread running through the thesis was the exploration of ways of describing and representing moving bod-

ies. A range of representations of human movement was trialled throughout the three projects as potential design tools. The design representations of movement needed to have the following characteristics in order for them to function adequately as tools for exploring movement as input. First, the design representations of movement must retain adequate references to the lived experience of movement in order to re-enact and re-generate the process and quality of the movement. Second, the design representations are produced from the perspective of being able to think through possible translations or mappings from the execution of movement by people to the detection and interpretation of those movements by a computer system. A set of design representations of moving bodies was developed in this thesis with these characteristics and includes movement-oriented personas and scenarios, spatial movement schemas in Labanotation floorplans and visual movement sequences analysed and annotated with Laban Effort-Shape description.

Language for describing movement was explored through the application of the Laban system of movement analysis and description and an examination of the language used by dancers for describing the experiential aspects of movement and for devising or choreographing movement. The Laban system was trialled in all three projects and provides a common language for describing the structural, spatial and temporal aspects of movement and the qualitative, dynamic aspects of movement in terms of Effort-Shape. The language of individual dancers was investigated in the third project. Their descriptions of movement tended to reflect their training and did not necessarily employ the same terms as the Laban system, particularly with regard to Effort-Shape. This resulted in the adoption of terminology from both the Laban system and the language of individual dancers in the design methodology of Moving and Making Strange.

The questioning of the relations between conceptions of movement and assumptions built into machine interpretations of moving bodies lies at the heart of the design of movement-based interaction. This thesis offers the adaptation of Suchman's analytic framework as a design tool to facilitate this inquiry. This new design tool is called the *Moving-Sensing schema*. The adaptation of Suchman's analytic framework as a design tool was success-

fully trialled in the projects, Eyetoy and Bystander. It provides a frame for exploring, interrogating and evaluating the interactions between the movements of people and the sensing and interpretations of those movements by the machine. It emphasises the resources available to both user and machine for perception and action. It is also valuable for making explicit the inherent ambiguity in interpretations of human actions from purely visual means and highlights the challenges in using human movement as direct input to interactive systems built on video-based, motion-sensing technologies.

In summary, the contributions of this research include:

- Design Methodology of Moving and Making Strange: a design approach to movement-based interaction that prioritises the experiential, moving body and consists of methods and tools for exploring, experiencing, describing, representing and generating movement.
- Laban movement analysis and Labanotation as a design tool.
- Moving-Sensing schema: Suchman's analytic framework adapted as a design tool.
- Extension of existing human-centred design tools to explicitly represent moving bodies, in the form of movement-oriented personas and scenarios.
- Patterns of watching: a catalogue of audience behaviour in terms of movements and stillness in relation to engagement with a specific interactive, immersive artwork.
- New methods for generating, enacting and experiencing movement, sourced from dance and movement improvisation practices and incorporating the principle of making strange.

10.2 Future Work and Applications

A number of possible avenues exists for future work. These include validating the utility of the methodology in actual practice; exploring movement im-

provisation scores for enactment and evaluation; choreographing new movements; investigating Body-Mind Centering and Bodyweather as sources of making strange; extending the methodology to other kinds of movement-based interactive technologies; and the applicability of the methodology to phenomenologically- and ethnographically-inspired approaches to technology design.

10.2.1 Validating the methodology in actual practice

The first avenue is the application of the design methodology to a concrete design situation. This would serve to validate the utility of the methodology as well as to further develop the methodology in actual practice.

10.2.2 Movement improvisation scores for enactment and evaluation

An interesting avenue of exploration is the use of scoring and other improvisational techniques for directing and improvising the movements of users in enactment and evaluation of interactive systems. In the development of Bystander, movement-oriented scenarios were used to direct the activities of people representing users during user testing. However, movement improvisation scores could be a useful technique for generating the relevant kinds of movement for other specific interactive systems.

10.2.3 Choreographing new movements

One still embryonic area of the design methodology of Moving and Making Strange is that of inventing and choreographing new movements for use in interactive, immersive spaces and with other interactive systems. This area could be expanded and developed further by continuing to work with dance choreographers and movement improvisation practitioners. The development of design methods for working with the moving body as a design material and design sensibility is an emerging area to which this thesis has contributed and

seeks to further. The specific relations between the choreographing of movements for interaction, the potential interactive treatments of the movements and user experiences and meaning-making are open for further investigation.

10.2.4 Body-Mind Centering and Bodyweather

Potential sources of techniques for making strange include dance, movement improvisation and somatics as these disciplines provide attentional strategies and movement techniques based in the experiential, moving body. Two specific practices, of which I have personal experience, Body-Mind Centering (Cohen, 1993) and the Bodyweather School of Butoh, offer opportunities for further research into practices of making strange with the moving body.

Body-Mind Centering (BMC) is an experiential exploration of the relationship between the body and mind. It involves "direct experience of anatomical body systems and developmental movement patterns, using techniques of touch and movement repatterning." (Hartley, 1995, p.xxix, Introduction) It draws on Western and Eastern scientific knowledge and was developed by Bonnie Bainbridge-Cohen in the 1970s. The fundamental premise is that "the qualities of any movement are a manifestation of how mind is expressing through the body at that moment. [...] Conversely, when we direct the mind or attention to different areas of the body and initiate movement from those areas, we change the quality of our movement." (Cohen, 1993, p.1) One example from BMC is the exploration of the head-as-a-limb for accessing the imagination. This could potentially offer an entry point for designers to access the creative potential of the moving body. Another line of investigation is a further analysis of the act of falling using Body-Mind Centering righting reactions and equilibrium responses to see if it yields useful perspectives and data for movement-based interaction design.

Bodyweather is an open investigation into the moving body and a broad-based physical training drawing from both eastern and western dance, sports training, martial arts and theatre practice (de Quincey, 1988). It was originated by Min Tanaka in Japan and introduced to Australia by Tess de Quincey in 1988. The training is fundamentally concerned with making

strange, with breaking habits of perception and the social mask through movement techniques grounded in sensorial focus and generative imagery. It is a potentially interesting area for interdisciplinary work.

10.2.5 Extension to other kinds of movement-based interactive technologies

The design methodology of Moving and Making Strange can also be extended to the design of other kinds of movement-based interactive technologies, not just interactive, immersive spaces built on video-based, motion-sensing technologies. Some possible areas of application include interactive entertainment, tangible and embedded computing, mobile and ubiquitous computing and robotics. The choice of sensors and input devices for detecting and recognising various aspects of movement is easily accommodated in the methodology and influences the forms of representation required in the design process.

The contemporary use of the Nintendo© Wii™ (a handheld, motion-sensing interactive device) as a rehabilitation tool for people suffering from impaired movement function as a result of stroke or burns suggests a potential application area for the methodology. The methodology's emphasis on the lived experience of movement and ways of accessing the creative potential of the moving body suggest interesting ways of understanding and extending the movement possibilities of people with impaired movement function.

10.2.6 Applicability to phenomenologically-inspired and ethnographically-inspired approaches to technology design

This thesis contributes to a long history of phenomenologically-inspired and ethnographically-inspired approaches to technology design. These approaches share a commitment to understanding the lived experience of potential users of technology. Ethnographically-inspired approaches to technology design typically utilise ethnographic fieldwork to obtain understandings of the practices of potential users of technology as a precursor to design. Both ap-

proaches to technology design imply an openness to phenomena and to developing understandings of phenomena and practices beyond what is given. This openness is reflected in the principle of making strange that pervades the design methodology of Moving and Making Strange developed in this thesis.

Given the phenomenological foundations of the design methodology, it lends itself to design from fieldwork. The general principles of the methodology include making strange, investigation of lived bodies, different, multiple perspectives and different kinds of representations. These principles motivate a design approach that can easily be extended into other kinds of technologies, not just movement-based interactive technologies. The methodology has great potential for providing a general framework for conducting technology design and research where the multiple perspectives of the first-person experiential, the observer and the machine are equally valued.

The motivating hope is that the application of the design methodology of Moving and Making Strange to the design of future interactive technologies will create new environments, new forms of engagement and new realms of experience that support and extend the experiential, moving body in its fullness of being.

To date, the work in this thesis has contributed to the wider research community by being published in two international journals and seven peer-reviewed conferences, as listed below.

1. L. Loke and T. Robertson. Design representations of moving bodies for interactive, motion-sensing spaces. International Journal of Human Computer Studies, 2009.

2. L. Loke and T. Robertson. Inventing and devising movement in the design of movement-based interactive systems. In Proceedings of OZCHI2008, December 2008.

3. L. Loke and T. Robertson. Making strange with the falling body in interactive technology design. In Proceedings of the 3rd European Con-

ference on Design and Semantics of Form and Movement (DeSForM), December 12–13 2007.

4. L. Loke, A. T. Larssen, T. Robertson, and J. Edwards. Understanding movement for interaction design: Frameworks and approaches. Journal of Personal and Ubiquitous Computing, Special Issue on Movement-based Interaction, 11(8), 2007.

5. T. Robertson, T. Mansfield, and L. Loke. Designing an immersive environment for public use. In Proceedings of PDC2006, 1–5 August 2006.

6. L. Loke, A. T. Larssen, and T. Robertson. Labanotation for design of movement-based interaction. In IE2005: Proceedings of the second Australasian conference on Interactive entertainment, pages 113–120, Sydney, Australia, 2005. Creativity & Cognition Studios Press.

7. L. Loke, T. Robertson, and T. Mansfield. Moving bodies, social selves: Movement-oriented personas and scenarios. In OZCHI 2005, Canberra, Australia, 23–25 November 2005.

8. L. Loke and T. Robertson. Movement-oriented personas and scenarios. In Approaches to Movement-Based Interaction (W9) Workshop at Critical Computing 2005: Between Sense and Sensibility, The Fourth Aarhus Conference, 21 August 2005.

9. T. Robertson, T. Mansfield, and L. Loke. Human-centred design issues for immersive media spaces. In Proceedings of FUTUREGROUND 2004, the Design Research Society's International Conference, 17–21 November 2004.