

Chapter 9

A Design Methodology of Moving and Making Strange

Calling attention to ourselves in movement in this way [by performing free variations on our own habitual movement patterns to appreciate first-hand what is kinetically there], we have the possibility of discovering what is invariantly there in any felt experience of movement. This is because whatever the habitual movement, it now feels strange, even uncomfortable. Just such oddness jars us into an awareness of what we qualitatively marginalize in our habitual ways of doing things. By *making the familiar strange*, we familiarize ourselves anew with the familiar. (Sheets-Johnstone, 1999a, The Primacy of Movement, p.143, my emphasis)

This chapter presents the primary contribution of the thesis, the design methodology of Moving and Making Strange. The design methodology is underpinned by a commitment to designing movement-based interaction from experiences of movement. It stems from a phenomenologically-inspired inquiry into the moving body, where we investigate our own experiences of movement, together with the experiences of others. The chapter is organised into three main sections. The first section introduces the notion of making strange and its usage in other arenas; the second section explains the genesis of the methodology and the third section defines what is in the methodology and how to use the various methods and tools.

9.1 Making strange

Making strange. Making the familiar strange. Making strange with the familiar. Defamiliarising. The term defamiliarisation was introduced by Victor Shklovsky, a member of the Russian formalist school of literary theory. In his essay, *Art as Technique*, published in 1917, he proposes that the method of defamiliarisation is used in art and literature to remove the automatism of perception.

The purpose of art is to impart the sensation of things as they are perceived and not as they are known. The technique of art is to make objects ‘unfamiliar,’ to make forms difficult, to increase the difficulty and length of perception because the process of perception is an aesthetic end in itself and must be prolonged. (Shklovsky, 2000, first published in 1917)

Making strange or defamiliarising is a basic strategy in artistic expression (Danto, 1981), creative design practice and in ethnography (Marcus and Fischer, 1986). For example, turning a picture upside-down interrupts our habitual patterns of visual perception and allows us to see the composition from a new perspective (Edwards, 1979). Alternatively, we could turn our body upside-down to gain a similar, yet different, change in perspective! Edward de Bono (1994) advocates a similar approach with his set of thinking tools that aim to counteract the natural tendency of the mind to operate within engrained patterns of perception. In design, the *cultural probes* of Gaver et al. (1999) employ the basic strategy of defamiliarisation by prompting participants to reflect on their everyday lives through the materials comprising the probes. Djajadiningrat et al. (2000) also work from a stance of making strange with their *interaction relabelling* method for the design of aesthetic interactions with products. Here possible interactions with an existing mechanical device are mapped to functions of a future electronic device. The use of unrelated devices enables innovative design thinking outside of the standard interaction style and opens up the spectrum of actions that can be used. Gaver, Beaver, and Benford (2003) suggest ambiguity as a resource for design that can foster close personal engagement with interactive

artefacts. A questioning attitude is invoked in the interpretative relationship between person and artefact.

Geertz (1973) describes anthropology's preoccupation with the exotic as a device for making the familiar strange. The breaching experiments of Garfinkel (1967) were designed to disturb familiar ways of perceiving everyday life. Marcus and Fischer (1986) identify two forms of defamiliarisation prevalent in anthropology—epistemological critique and cross-cultural juxtaposition. Bell et al. (2005) employ a method of making strange, or defamiliarising, understandings of the home in the design of domestic technologies. They use ethnographic techniques together with defamiliarisation as a literary technique for writing narratives of the home to “rethink assumptions built into domestic technologies” (Bell et al., 2005).

The notion of “making the familiar strange” is described in relation to the *moving body* by the phenomenologist, Sheets-Johnstone (1999a) in the opening quote. Through varying our normal movement patterns and processes we can unsettle our habitual perceptions of the world and ourselves. One way of reacquainting ourselves with familiar or habitual movements is to do a familiar movement differently, to perform the movement with a range of kinetic variations and so reveal the specific felt quality of the original movement. As Sheets-Johnstone (1999a) describes with the act of walking,

Changing not only our leg swings, for instance, by initiating movement from our ankle joints by a spring action rather than from our hip joints, but changing our arm swing, the curvature of our spine, the cadence of our walk, the amplitude of our step, and so on.

Similarly, performing a movement outside or on the periphery of our everyday realm, such as learning a new physical skill or performing an unfamiliar movement, such as falling, can also bring us into a fresh encounter with our movement possibilities and break us out of habitual ways of thinking about movement.

In the context of the design of movement-based interaction, this unsettling or *making strange* through the moving body serves the purpose of breaking out of old patterns of perception to arrive at fresh appreciations and perspec-

tives for design that are anchored in the sensing, feeling and moving body. Creative thinking in design requires an overturning of our habitual perceptions and conceptions of things or, in this case, of the sensing, feeling and moving body.

9.2 Genesis of methodology

The methodology is characterised by two fundamental needs that directly address the second and third research questions of the thesis. The first is ways of accessing the experiential nature of the moving body, that are rooted in our own bodily knowing and/or the lived experience of other moving bodies. The second is the production and use of descriptions and representations of the moving body for design. In particular, representations that facilitate the mapping of the interaction between human activity, in terms of movements performed and the experience of such movements, and possible interpretations of the moving body by the machine. In this methodology, it is not enough to understand and describe movement from the perspective of the observer alone. An adequate understanding and description of the experiential, moving body can only be formed through an integration of multiple perspectives, including the first-person understanding of the mover, the observational perspective of the designer/researcher and the direct experience of movement by the designer/researcher. One of the main principles of the design methodology is a return to the active, experiencing body. Many of the methods are concerned with acquiring direct experience of the moving body in various design activities. These methods I term ‘experiential methods’.

The methodology in its current form is an expansion and refinement of the methodology first presented in Loke and Robertson (2007), resulting from the first study of the third project (section 7.1). The activities, data and results of analysis for all three projects were further examined as sources of methods and tools for potential inclusion in the developing methodology. The methods and tools were abstracted from their original domain and reframed to be applicable, at least as a starting point, to any movement under investigation. The use of these methods and tools may be tailored and adapted according

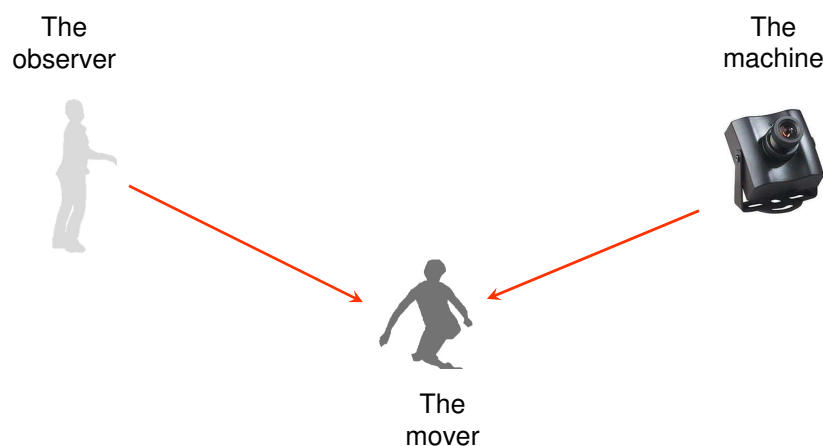


Figure 9.1 The three perspectives of the mover, the observer and the machine offered in the design methodology of Moving and Making Strange

to the specific research or design context.

9.3 What is in the methodology

The methodology offers methods and tools for exploring, experiencing, understanding, describing and representing the moving body that can assist designers in making movement and interaction choices that are grounded in the sensing, feeling and moving body. It is intended as a tool-kit for designers, from which they can select methods and tools as appropriate or add their own. It is *not* a prescription for designing. The methodology is characterised by the use of multiple, different perspectives, which enables the designer to shift between the three perspectives of the mover, the observer and the machine (see Figure 9.1).

The methods and tools are organised by activity. A diagram of the activities and how they are related is given in Figure 9.2. This diagram can function as a navigational aid to the methodology. Figure 9.3 then provides the set of methods and tools utilised in a specific activity and the particular perspectives and data offered by that activity.

In the following sections, a consistent format is used to describe each activity and its methods and tools, as follows. A schematic diagram introduces

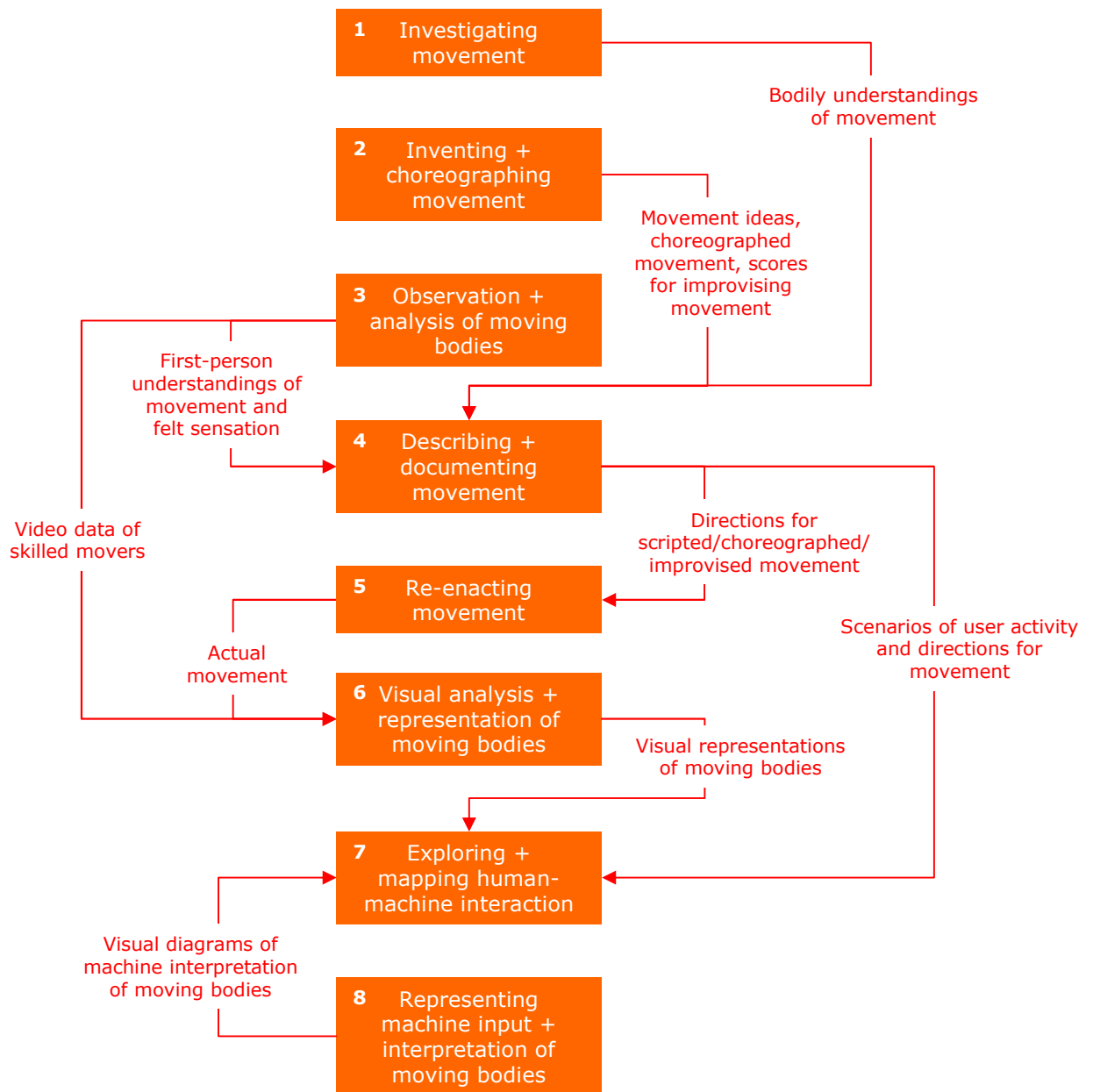


Figure 9.2 The design methodology of Moving and Making Strange: Diagram of activities and how they are related. The labels on the arrows indicate the data generated by one activity and the direction of the arrow indicates the flow of data from one activity to another. The activities are numbered purely to assist identification; the numbering does not indicate a linear order.

Activity	Method/tool	Perspective/Data
1 Investigating movement	Kinetic variations of speed, scale and direction Exploring internal and external perception Finding pathways Breaking down a technique Imagery	First-person experiential data and perspective on movement possibilities and corresponding felt sensations
2 Inventing and choreographing movement	Working with parameters and qualities of movement: <ul style="list-style-type: none"> Scoring Variations on a traditional movement form or gesture From words/concepts/images	First-person experiential data and perspective on movement possibilities, forms, patterns, motivations and corresponding felt sensations
3 Observation, interrogation and analysis of moving bodies	Physical demonstration and interrogation Understanding movement from a first-person experiential perspective: <ul style="list-style-type: none"> First-person experiential accounts Characteristic components of movement Understanding how the movement is performed from an observational perspective	First-person experiential data on process and felt sensation of movement Observational data on the sequencing and bodily organisation of the body-in-motion
4 Describing and documenting movement	Describing user activity: moving personas and movement-oriented scenarios Describing skilled or choreographed movement: combination of images, text, annotations and sketching Laban movement analysis: Structural and Effort/Shape descriptions	Observational perspective documenting the movements of people and the motivations for movement
5 Re-enacting movement	Re-enacting movement-oriented scenarios, movement scores and directions for choreographed movement	First-person experiential understandings of movement during user testing/evaluation
6 Visual analysis and representation of moving bodies	Movement sequences and silhouettes Spatial movement schemas in Labanotation floorplans	Observational perspective for visually analysing and representing human movement
7 Exploring and mapping human-machine interaction	Interactivity table (adapted from Suchman's analytic framework)	Mapping between the human and machine perspectives, both from an observational perspective
8 Representing machine input and interpretation of moving bodies	Machine input schemas	Machine perspective of the input and interpretation of moving bodies

Figure 9.3 Summary of activities, methods and tools and the perspectives/data they offer in the design methodology of Moving and Making Strange

the activity, highlighted in an orange box, in its context within the methodology (the grey boxes indicate the activities to which it is linked). The purpose of the activity is then described, including the kind of data or perspective offered by the methods/tools (summarised in Figure 9.3) and the relations between the various activities (summarised in Figure 9.2). Each method/tool is described, including examples of specific usage of the methods and tools drawn from the three research projects. Where appropriate, exercises are offered for investigating, generating and enacting movement. Each section concludes with reference to related work of other researchers or practitioners.

9.3.1 Investigating movement

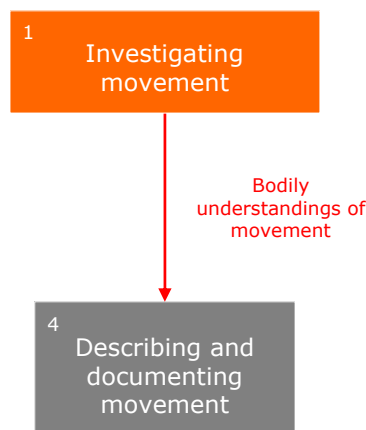


Figure 9.4 The activity of investigating movement and its place in the methodology

This area of the methodology is concerned with accessing the experiential, moving body *directly* with one's own body. This is achieved through movement inquiry and practices of *making strange*. One can begin an inquiry into the potential movement possibilities and felt sensations of one's own body by performing a familiar movement differently or by performing an unfamiliar movement. We can select physically challenging or unorthodox movements, such as falling, for investigation. The movement inquiry can be deepened through repetition of movements to consciously access in-the-moment sensations and process. The methods and techniques presented here provide ways of exploring and improvising with the moving body to cultivate skill and a refined awareness of the sensing, feeling and moving body. They form but a small part of an established repertoire of movement improvisation techniques from dance and movement practices. The bodily understandings of movement gained from these techniques provide a foundation for the activity of describing and documenting movement (see Figure 9.4). Just as importantly, the creative potential of the experiential, moving body is opened up and available for use in the design process.

Kinetic variations of speed, scale and direction

One can perform a movement with kinetic variations of speed, scale and direction to produce different dynamics and qualities of movement. For example, swinging your arm to and fro very slowly and smoothly or with a jagged stutter. The focus here is on the relation between the movement and the felt sensation of movement.

An exercise for investigating kinetic variations of movement is given in Figure 9.5.

Exploring internal and external perception

The sensing of the external environment is performed predominantly with the visual and tactile organs of perception, the eyes and the skin, respectively. The sensing of the dynamics of our body-in-motion and the internal environment of the body is governed by the kinaesthetic sense. There are simple exercises to heighten awareness of the different senses and understand how they influence our ability to perform various kinds of movements. For example, exploring the act of balancing on one leg with the eyes open and then with the eyes closed. With the eyes open, our vision assists with balancing and stabilising ourselves in space. With the eyes closed, a more internal understanding of what is involved in balancing on one leg opens up. The field of somatics focuses particularly on cultivating awareness of movements and corresponding felt sensations and relationships in the body (Feldenkrais, 1972; Bartenieff and Lewis, 1980; Hanna, 1988; Cohen, 1993).

An exercise for exploring the head righting reflex in balancing and the involvement of our visual and kinesthetic sensing is given in Figure 9.6.

Finding pathways

We can experiment with finding pathways into a pattern or form of movement by varying the source of initiation of movement from different parts of the body. For example, walking through space with the right hip or the knees or the back of the head leading. The use of the *head-as-a-limb* in Body-Mind Centering is thought to open up the imagination (Cohen, 1993, p.133). Here

Investigating the act of walking by varying the speed, direction and scale of the movement

The aim here is to develop sensing and awareness of your body-mind through a playful inquiry into movement possibilities with your own body. A good place to start is with the act of walking.

Experiment with your normal way of walking through variations of direction and speed. Start walking at your normal pace. Walk in different directions – forwards, backwards, sideways and notice how this affects the action of the walk and the feeling of your body.

Then double the speed of your pace and notice what happens to the movements. And then walk at half your normal walking pace and then at quarter speed. Make clear decisions about which of the four speeds you chose. What do you notice, internally and externally?

Now walk as slowly as possible and notice how this changes the length of your stride. Then vary the length of your stride all the time at very slow speed.

Then use the stride of your normal walk but move at 1 cm per second maximum total body speed. Then at 1mm per second.

As you play with different parameters, take your awareness to how each change feels in the body and what the ground feels like under your feet.

As you walk, experiment with changing the focus of your gaze. Look at different points in the space, or let your focus be soft and directed to a wide area. Change the direction of your focus and vary the duration you look before changing to a new focus. Do the changes in focus affect the felt sensation of the movement? Note also what parts of the body are harnessed to achieve the movement.

Find language for the felt sensations by working with a partner. One person move and the other observe, then change roles and discuss your experiences afterwards. Note the different forms of language each person employs in describing movement and its qualities. Exchange understandings of the relation between variations of speed, scale and direction to the felt sensation of the movement.

Inspired and sourced from the Bodyweather movement investigations, led by Tess de Quincey in Sydney, Australia 2007.

Figure 9.5 An exercise for investigating kinetic variations of movement

Exploring the labyrinthine head righting reflex

1. Work in partners. One person plays on a large gymnastic ball in prone, supine, sidelying or sitting position. The other person observes the head righting movements to vertical as the person moves to keep their balance on the ball and to catch themselves when falling to the ground.
2. Remove the influence of the Optical Righting Reaction by closing your eyes.

Sourced from the Body-Mind Centering system of movement study, Bonnie Bainbridge Cohen, *Sensing, Feeling and Action*, 1993, p.127

Figure 9.6 An exercise for exploring the head righting reflex in balancing and the involvement of our visual and kinesthetic sensing

the head is actively exploring and leading the body through space. It is not rigidly held nor overly yielding to gravity.

Breaking down a technique

A specific form of movement can be learnt and understood by breaking down the technique into a sequence of preparatory exercises. For example, the technique of falling by sliding out to the side from upright, can be mastered by starting from a kneeling position on the ground and then progressing to standing.

Imagery

A different kind of technique uses imagery to shape body movements and generate distinct movement qualities, such as ‘like a heavy stone’ or ‘like a floating feather’. The image can be localised to a part of the body or it can be extended beyond the physical body. For example, you might move your leg as if it contained a viscous fluid. Or you might imagine that a long string was pulling you up by the crown of the head towards the heavens.

An exercise for generating movement through imagery is given in Figure 9.7. This exercise is often used as a Butoh training technique.

Generating movement through imagery

This exercise is based on the notion that the body is predominantly water.

Standing upright, feel water slowly rising up through the soles of your feet to the top of your head. At first this process can take 10-15 minutes. It becomes an internal meditation. Have a sense of buoyancy and lightness. You can allow your arms and hands to follow. Take the time to feel water infusing every small part of your body as it rises. Allow the body to be moved by the water. The physical shell is passive. Allow the imagination to activate your movement. For example, you can imagine that you are a strap of seaweed anchored to a rock. Gently undulating waves caress your form and move it in the water. Allow your mind to free itself from being in control of the body. The water inside is moved by the water outside. See if you can feel individual cells, filled with fluid, rolling and sliding over each other.

This process can be reversed. That is, feel the water gradually drain out through the feet.

Contributed by Bronwyn Turnbull, inspired and sourced from Noguchi Taiso.

Figure 9.7 An exercise for generating movement through imagery

Related work

- *Fundamentals of movement*: Bartenieff and Lewis (1980), Laban (1971), Newlove (1993), *Body-Mind Centering*: Cohen (1993), Hartley (1995), *Somatics*: Feldenkrais (1972), Hanna (1988)
- *Movement improvisation*: Blom and Chaplin (1988), *Butoh*: Fraleigh (1999)
- *Movement games*: Donovan and Brereton (2004)
- *Mask work*: Jacucci (2006)

9.3.2 Inventing and choreographing movement

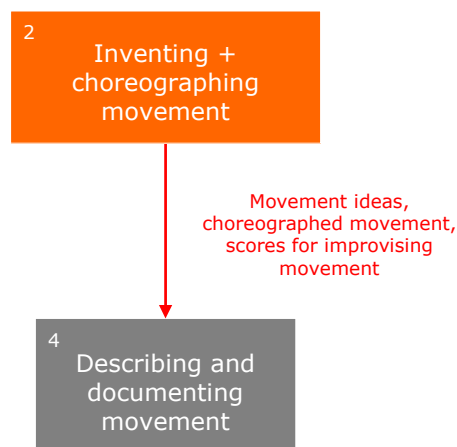


Figure 9.8 The activity of inventing and choreographing movement and its place in the methodology

The methods and tools presented here are for choreographing movement, that is, for inventing and devising new forms of movement. In future movement-based interactive spaces, we will need different kinds of movements with meanings that are, as yet, unthought. These new movements may be improvised, choreographed, emergent or structured movement systems. This activity feeds into the activity of describing and documenting movement (see Figure 9.8).

Ways of inventing and devising movement can be broadly split into two categories: (1) working with parameters and qualities of movement and (2) through inspiration from concepts, text, images and other means of intellectual thinking that is then translated into movement. A design imperative for generating meaningful movements is the importance of providing a specific and well-defined context or domain.

Methods for inventing and devising movement are part of the practices of *making strange* through movement inquiry and overlap in part with the methods for accessing the experiential, moving body. This is an area of the methodology that can be substantially expanded in the future by continuing to work with choreographers and movement improvisation practitioners.

Working with parameters and qualities of movement

The activity of inventing and devising new movements can begin with the sensing, feeling, moving body. The method of *scoring* used in practices of movement improvisation provides a structure for generating and devising movement based on a set of elements or parameters that can be varied as desired. For example, a simple score consists of three elements; walking, standing still and squatting. Parameters or constraints related to speed, duration, timing, scale, focus, use of space and so on, can be added to the score. Scores can be used for improvising movement whilst exploring movement ideas for interaction or for generation and enactment of movement in user testing (see section 9.3.5).

Another approach is to begin with a traditional movement form or gesture. This form or gesture can then be choreographically developed by varying the parameters and qualities of movement. For example, in Project III (Falling into Dance) Gloria begins with the “blow through palms to clean” gesture from a Qi Gong form. She begins by breathing into the hands in prayer position and focusing on the rhythm of the breath. She plays with the hands expressing the expansion and contraction of the lungs, varying the scale and speed of the hand movements, until a certain arrangement of gestures and body movements is reached.

From words/concepts/images

Methods for inventing and devising movement can begin with a word, concept or image. These can generate or inspire a movement impulse, kinaesthetic sensation, a particular way of moving, spatial arrangements of the body in relation to itself, other bodies and the body in space and so on. Choosing a specific context or domain is critical to generating meaningful movement. A specific and well-defined context gives structure and meaning to movements.

Related work

- *Dance and movement improvisation*: Blom and Chaplin (1988), Forsythe and Sulcas (2000), Laban (1971), Newlove (1993)

- *Designers working with movement for interaction:* Hummels et al. (2007), Jensen (2007), Jensen et al. (2005), Klooster and Overbeeke (2005), Moen (2005, 2007), Schiphorst and Andersen (2004)

9.3.3 Observation, interrogation and analysis of moving bodies

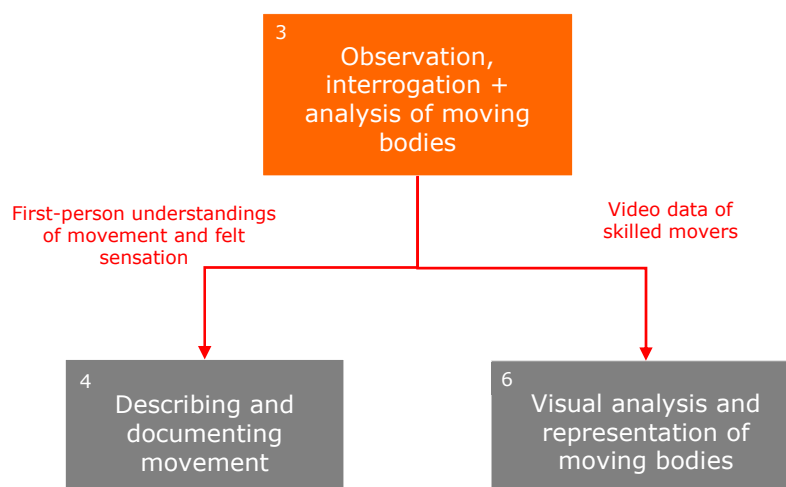


Figure 9.9 The activity of observation, interrogation and analysis of moving bodies and its place in the methodology

The experiential, moving body can be accessed indirectly through observation, interrogation and analysis of other moving bodies. Conducting movement inquiries with skilled movers provides finely nuanced understandings of particular kinds and forms of movement. The focus is on what a particular movement looks like, how it is performed, what happens to the body during the execution of the movement and how it feels in the body. This activity is a precursor to those of describing and documenting movement and visual analysis and representation of moving bodies (see Figure 9.9). The methods and tools presented here include physical demonstration and interrogation, understanding movement from a first-person experiential perspective and understanding how the movement is performed from an observational perspective.

First-person experiential account

I get a lot out of just the sense of weight, so exactly that. So if that's [touching the crown of the head] being pulled up, I've just been strung up then this is an entire weightedness. You really try and get the sense of, like a sack of potatoes, really heavy in the body. This is being kind of hooked up there. And so then that really heavy feeling. Particularly in the fingertips, in the legs and the feet and the thighs and the butt, especially in the pelvis. I tend to work with slightly bent knees. To get a sense of that suspension.

Participant 7, Study of Falling

Figure 9.10 First-person experiential account of the process and felt experience of falling by a skilled mover

Physical demonstration and interrogation

One method of accessing bodily knowledge is through physical demonstration by the mover, coupled with interrogation by the observer. This produces verbal descriptions of their movement processes and felt sensations. Recording this activity on videotape provides raw data of moving bodies for feeding into the tools for analysing, describing and representing movement.

Understanding movement from a first-person experiential perspective

These descriptions preserve the voice of the person describing their understanding of their process and their felt experiences of particular movements. It focuses on their self-perception of their own movements, as well as their perception of the external environment.

First-person experiential accounts are edited transcripts of a person explaining how they perform a particular movement and how it feels in the body. An example from the Study of Falling, Project III (Falling into Dance) is given in Figure 9.10.

These accounts can be analysed into three *characteristic components of movement*: Movement process and technique, Sensing and awareness—internal and external and Felt quality. Each of these characteristic compo-

Characteristic component of movement	Definition	Examples of participant description
Movement process/technique	<p>The process of the movement and the technique for performing the movement are inter-related.</p> <p>Process is the dynamic unfolding of a bodily movement in space and time. The process may be split into distinct stages for a given movement, depending on the complexity of the movement.</p> <p>Technique is an established means for directing or informing the movement process.</p>	<p><i>Initiating the fall</i></p> <p>Finding pathways into the floor</p> <p>Finding steps to take you off-centre</p> <p>Momentum of dropping down</p> <p><i>Controlling the fall</i></p> <p>Internal muscular lift to slow down</p> <p>Working in opposite direction to the fall</p> <p><i>Contacting the ground</i></p> <p>Relax and soften</p> <p>Letting my body roll into the ground</p>
Sensing and awareness – internal and external	What senses are actively engaged and how; the senses include the visual, aural, tactile, and proprioceptive/kinaesthetic; awareness and relating of internal and external environment.	<p>Aware of your body within a larger space</p> <p>You need that visual to know where you are in the space, to remember what plane you are on, especially when you've thrown yourself off-centre</p>
Felt quality	The particular sensation or feeling as experienced in the whole or part of the body.	<p>Sense of weight, like a sack of potatoes</p> <p>Suspension and precariousness</p>

Figure 9.11 Definition and examples of characteristic components of movement for the act of falling by skilled movers

nents of movement is briefly defined in Figure 9.11, along with an example from the Study of Falling, Project III (Falling into Dance).

Understanding how the movement is performed from an observational perspective

Movement sequences are extracted from the video data to enable analysis of how the movement is performed from an observational perspective. Each still in the sequence is annotated with descriptions of the process and technique of performing that particular movement. Movement sequences are also used for visual analysis and representation (see section 9.3.6). Laban movement analysis can be applied to analyse and describe the movements in terms of Effort-Shape from an observational perspective (see also section 9.3.4).

An example of a movement sequence annotated with descriptions of the process and technique of falling, taken from the Study of Falling, Project III is given in Figure 9.12.

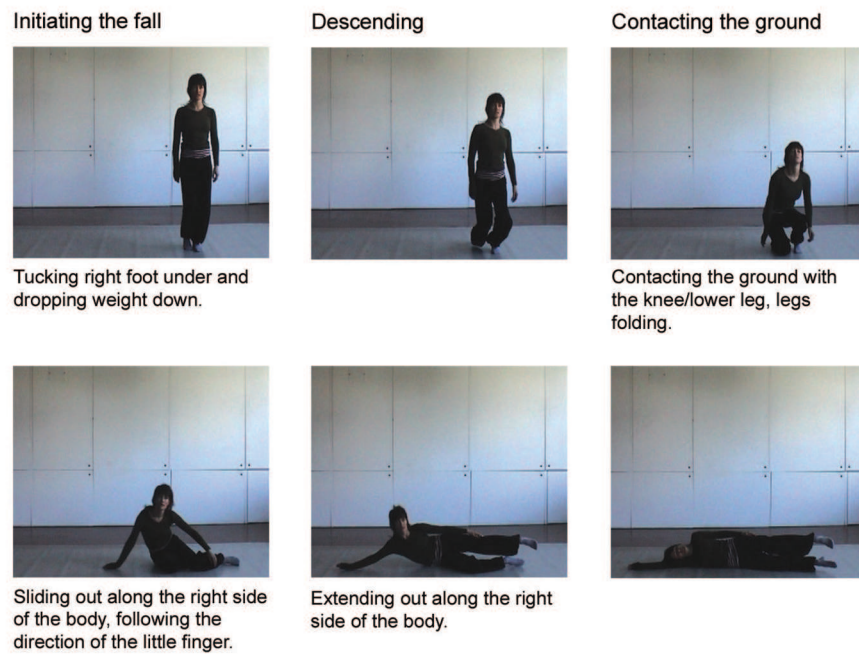


Figure 9.12 Movement sequence for participant 1, annotated with descriptions of the process and technique of falling

Related work

- *Movement analysis:* Bartenieff et al. (1984), Cohen (1993), Daly (1988), Laban (1971), Newlove (1993)

9.3.4 Describing and documenting movement

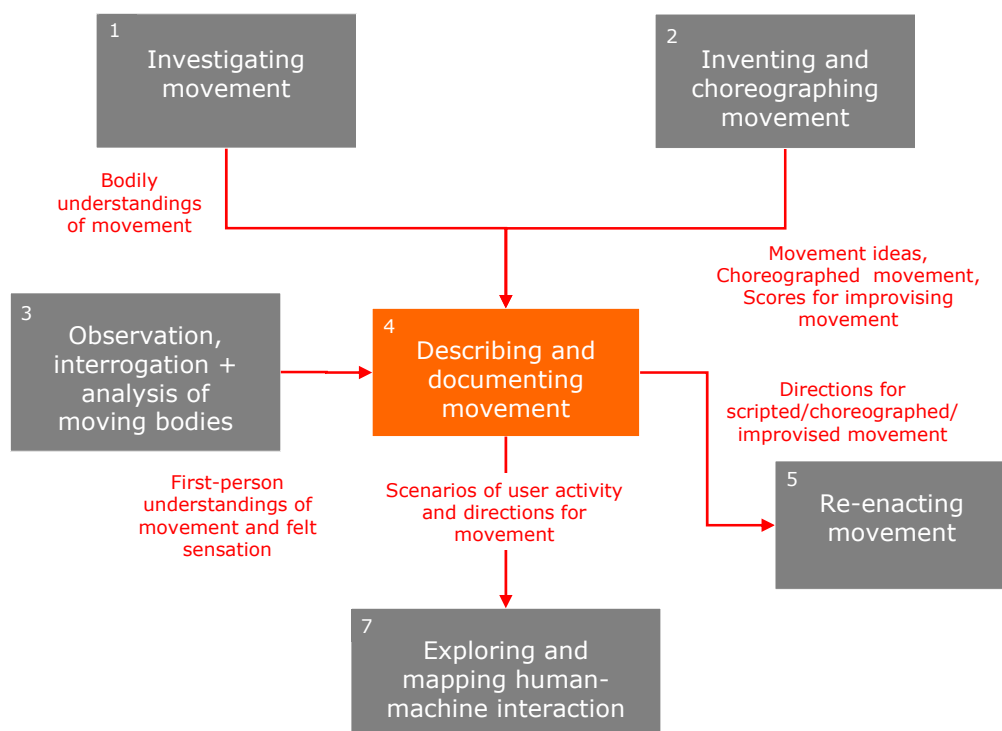


Figure 9.13 The activity of describing and documenting movement and its place in the methodology

We need language to describe movement that captures and evokes the wide range of possible understandings of movement for use in interaction design. The movements of different kinds of users or participants, in interaction with machines, can range from the everyday to highly skilled or choreographed movement. We can focus on the activity of users, the functional character of their movements and actions, the mechanics of their movement, the spatial patterns and organisation or the expressive quality of their movement, for example. Users of interactive, immersive spaces fall roughly into two categories: (1) visitor/spectator and (2) performer/skilled user. Visitors and spectators typically have limited or no prior knowledge of the system. Their interaction is mainly exploratory, learning or in the role of witness. Performers and skilled users typically have rehearsed with the system. Their actions tend to be choreographed or deliberate, governed by knowledge of

the system's behaviour.

The primary ways of describing and documenting movement for these different categories of users can be divided into descriptions with a focus on the activity of users (user category 1) and descriptions with a focus on the details and nuances of performing particular kinds of movements (user category 2). These descriptions can be used to re-enact and generate movement for testing and evaluation. They can also be used for exploring and mapping human-machine interaction (see Figure 9.13).

Describing user activity

Scenarios written from a third-person perspective are traditionally used in interaction design to describe the activities of users in specific contexts and settings, either actual observed activities or future imagined activities. These traditional scenarios have been extended here to include *movement-oriented* characteristics. *Movement-oriented* scenarios are textual descriptions of scenarios of user activity and movement based on personas. Here personas represent different kinds of moving users. *Movement-oriented* personas and scenarios can also be used prescriptively to generate or re-enact movement for testing and evaluation.

An example of a *movement-oriented* scenario from Project II (Bystander) is given in Figure 9.14.

Describing skilled or choreographed movement

For skilled or choreographed movement in interaction with the machine, much more detailed and specific description is required to document the movement for later re-enactment during user testing. These descriptions detail the specifics of how the body moves in space and time, the use of timing, repetition, rhythm, the form and phrasing of the movement and the interaction with other movers within the environment. They provide directions for performing the movement for later enactment. They may overlap in part with the scenarios. They can be written in the individual language of the choreographer or the Laban system of movement analysis and description can be

Movement-oriented scenario

This scenario explores the situation where a couple of people enter the Bystander room, which is currently empty. The characters, Val and Betty, are representative of older, retired people with a keen interest in the arts. They embody the fifth type of audience behaviour - *serious, quiet and contemplative engagement*. They enter the space and stand just inside the entry. A key event then occurs where a teenager attempts to enter the room but is blocked by Val and Betty. The teenager embodies the first type of audience behaviour - the *head-poker*. After the head-poker leaves, Val and Betty commence moving around the space, firstly towards the centre of the room and then towards one of the walls. They tend to move slowly with periods of stillness, as they observe the flock circling the room, revealing sets of images and texts. They chat and occasionally point things out to each other.

Figure 9.14 An example of a movement-oriented scenario taken from the Bystander project. It is built on the movement-oriented personas of Val and Betty.

utilised as a standard form of description.

An example of choreographic directions for movement, taken from Project III, is given in Figure 9.15.

Documenting movement ideas and choreography

Tools for documenting the movement ideas and choreography in forms that retain the essence of the movement or motivation for the movement include the use of text, images and sketching. One technique for documenting choreographic ideas is to provide choreographers or designers with a set of images and texts related to the thematic context of the work. They are then able to present their movement/choreographic ideas through a combination of images, text, annotations and sketching. This form of documentation can act as a resource for returning to the original ideas for movement/choreography.

An example of documenting movement ideas and choreography using a mix of text, images and sketching, taken from Project III, is given in Figure 9.16.

Act 2 – Ritualising the Space, Section 2

The four performers shift into treading a figure-of-8 path through the space. Their arms are held in front as if holding a pulsating ball of chi. The gesture changes to shifting side to side and drawing the ball of chi up and down in an arc. Occasionally a performer will stop at the end-point of the figure-of-8, stamp the foot and go into a frenzied form of movement with the arms and head.

These movements with the ball of chi exhibit a flowing, floating, rhythmic quality, that is interrupted every now and then with a very different movement (stamp and frenzied arms and head) to create a different energetic.

Figure 9.15 Directions for choreographed movement in Act 2, section 2

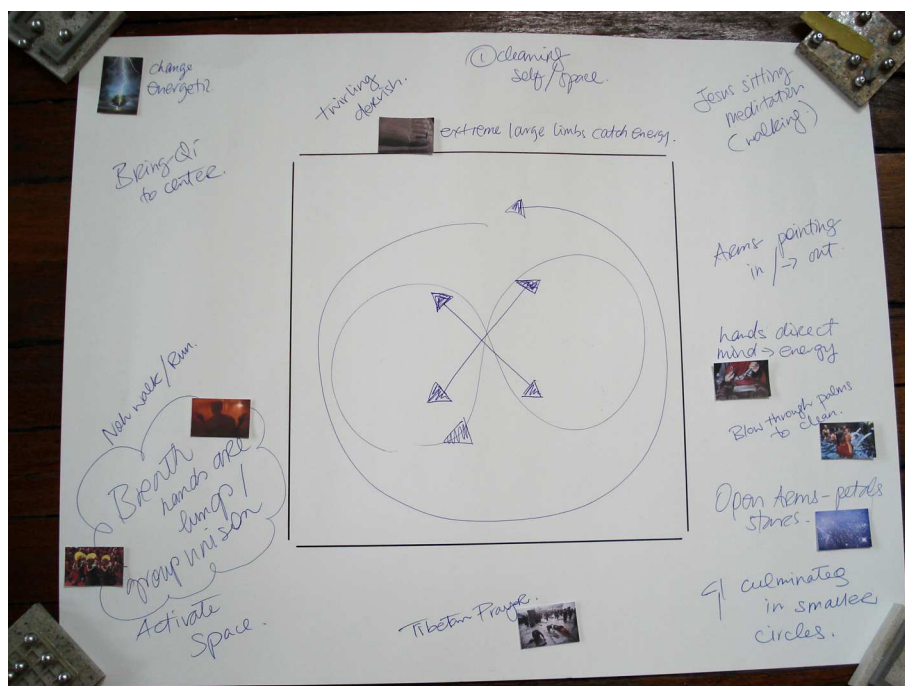


Figure 9.16 Gloria's use of the resource kit for documenting her choreographic and movement ideas



Figure 9.17 Effort-Shape analysis for a choreographed movement sequence

Laban movement analysis and description

In the Laban system of movement analysis, the *structural description* provides a vocabulary for describing the body and its parts, space (direction, level, distance, degree of motion), time (metre and duration) and dynamics (quality or texture, e.g. strong, heavy, elastic, accented, emphasised). The *motivation* for the movement is also described and can come from various sources: directional destination, motion, anatomical change, visual design, relationship, centre of weight and balance, dynamics and rhythmic pattern.

Laban's (1971) *Effort-Shape description* provides a system of analysis and a vocabulary for the qualitative, dynamic character of movement. The energy or Effort expended in a movement can be expressed in dimensions of Space, Time, Weight and Flow. The dynamically changing spatial shaping of a movement can be analysed with Shape categories describing the static form and the changing relation of the body to itself and the environment. Effort-Shape analysis provides a language for mapping from body-based to machine-based descriptions or interpretations. The qualitative, dynamic character of movement can also be described less formally, using evocative and metaphoric language that conveys the essence of the movement (Buur et al., 2004). An example of Effort-Shape analysis applied to choreographed movements from Project III is given in Figure 9.17.

We can use the Laban system to develop shared understandings of human movement, based in a standard vocabulary for describing movement. It is essential to gain an understanding of the Laban system of movement analysis grounded in one's own body. This can happen in tandem with developing one's observational skills using the Laban system of other moving bodies.

An exercise for developing skill in applying the Laban system of movement analysis is give in Figure 9.18.

Related work

- *Scenarios*: Bødker (1998, 2000), Carroll (2000a,b), Ehn and Sjögren (1992), Howard et al. (2002), Kyng (1995), Pedell and Vetere (2005)
- *Designers working with movement*: Brereton et al. (2003), Buur et al. (2000), Buur et al. (2004), Djajadiningrat, Matthews, and Stienstra (2007), Høysniemi and Hämmäläinen (2004), Jensen (2007), Jensen et al. (2005), Klooster and Overbeeke (2005)
- *Dance and somatics*: Feldenkrais (1972), Bartenieff and Lewis (1980), Bartenieff et al. (1984), Hanna (1988), Cohen (1993), Hutchinson (1977), Laban (1971), Lamb and Watson (1979)

Developing skill in applying Laban movement analysis

This exercise first explores the basic Effort action of Dabbing. Dabbing is Direct in Space, Sudden in Time and Light in Weight.

First explore Dabbing with free flow. Then with bound flow.

1. This action is clearly felt in the hands as in a painter dabbing at a canvas or in typing. Try dabbing with the right side leading across the body, diagonally backwards, over the opposite shoulder. Repeat with the left side leading.
2. Dab with the feet. It is easy to quickly point the heels or toes. Again, try in all directions and all zones.
3. Try with the knees, hips, shoulders, head, elbows, chin, back and chest. Take plenty of time to experience dabbing in all these parts of the body. Some parts will lend themselves more easily to the effort than others.
4. Try the action with steps. Knees can dab upwards and toes or heels downwards.

Working in pairs, one person leads in a succession of exploratory movements using one of the basic Effort actions. The other person observes and describes the movement in terms of the motion factors of Space, Time and Weight. The mover and the observer compare notes on the experience of performing an action with specific qualitative characteristics and observing and describing the action. The roles are then swapped and the other basic Effort actions are explored until each person has developed confidence in performing and observing movements using Laban Effort analysis. The observer may like to try mirroring the mover to see if this assists in developing observational skills.

Sourced and extended from Laban for Actors and Dancers, Newlove, 1993

Figure 9.18 An exercise for developing skill in applying the Laban system of movement analysis for observation

9.3.5 Re-enacting movement

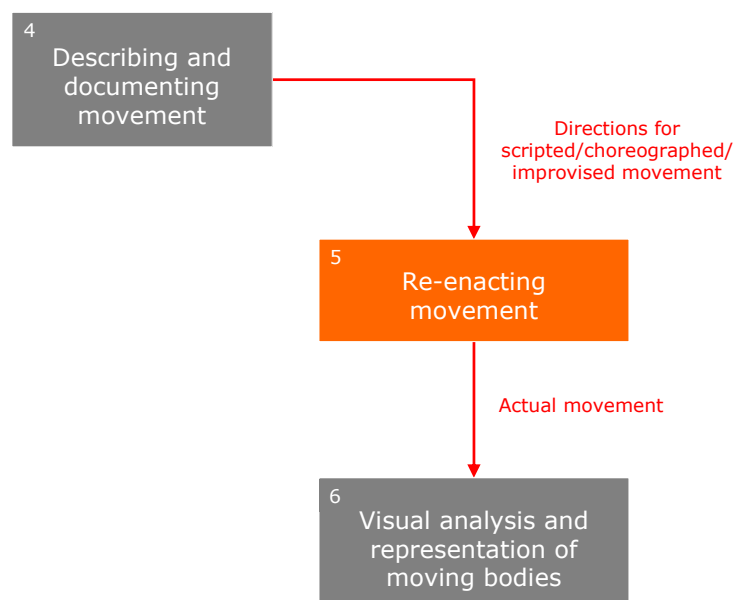


Figure 9.19 The activity of re-enacting movement and its place in the methodology

Re-enactment of scripted, choreographed or improvised movement, from design descriptions and representations of movement including movement-oriented scenarios, spatial movement schemas, movement scores and directions for choreographed movement, provides actual movement for use in testing and evaluation of the design of interactive systems. It feeds into the activity of visual analysis and representation of moving bodies (see Figure 9.19).

Enactment enables design reflection and refinement that is anchored in a bodily understanding of what it is like to act, move, perceive and respond in interaction with such systems. It provides designers with first-hand experiential data on the interactional viability of particular forms and patterns of movement. Felt, bodily experience can be garnered of architectural qualities of the interactive space such as the sense of scale, enclosure and spatial arrangement. The visual and sonic outputs of the system can be experienced kinaesthetically as well as visually and aurally. The effects of interaction between people on their actions, movements and perception can be gauged.

Time Min:Sec	Scenario and Key Events	Activity: Movement/Stillness	Spatiality: Path/Position/Orientation
01:00	<i>Slow-moving, contemplative visitors.</i> Betty and Val about to enter empty room.	Betty and Val enter room together and stand fairly still looking around with heads turning.	Stand just inside entrance.
01:30	<i>Head-poker.</i> Young teenager enters, blocked by Betty and Val, so leaves.	Young teenager enters room, then exits.	Just inside entrance.
02:00	Betty and Val decide to stay and watch more.	Betty and Val walk towards centre.	Straight path towards centre.
02:30 - 04:00	They watch the flock.	Slowly turning to watch flock, taking 1 or 2 steps each way.	Stand in centre facing wall w2.

Figure 9.20 Scripted movement corresponding to a movement-oriented scenario

Enactment of scripted, choreographed or improvised movement grounds the imaginings of user behaviour and experience in actual bodies.

An example of scripted movement corresponding to a movement-oriented scenario is given in Figure 9.20. It is from Project II (Bystander). For this particular system, it was important to distinguish the activity and movements of the users and their spatial paths, position and orientation. Links to the spatial movement schemas are normally included, although not shown in this example. The spatial movement schemas provide a visual representation of the spatial characteristics of the user activity—more detail is provided in section 9.3.6.

Three examples of movement scores for generating movement in user testing of an interactive, immersive space like Bystander are given in Figure 9.21. The order and timing of these elements is not prescribed and is improvised during actual performance of the score. More complex scores can be devised incorporating more parameters and constraints on the movement, as well as interactions with other people.

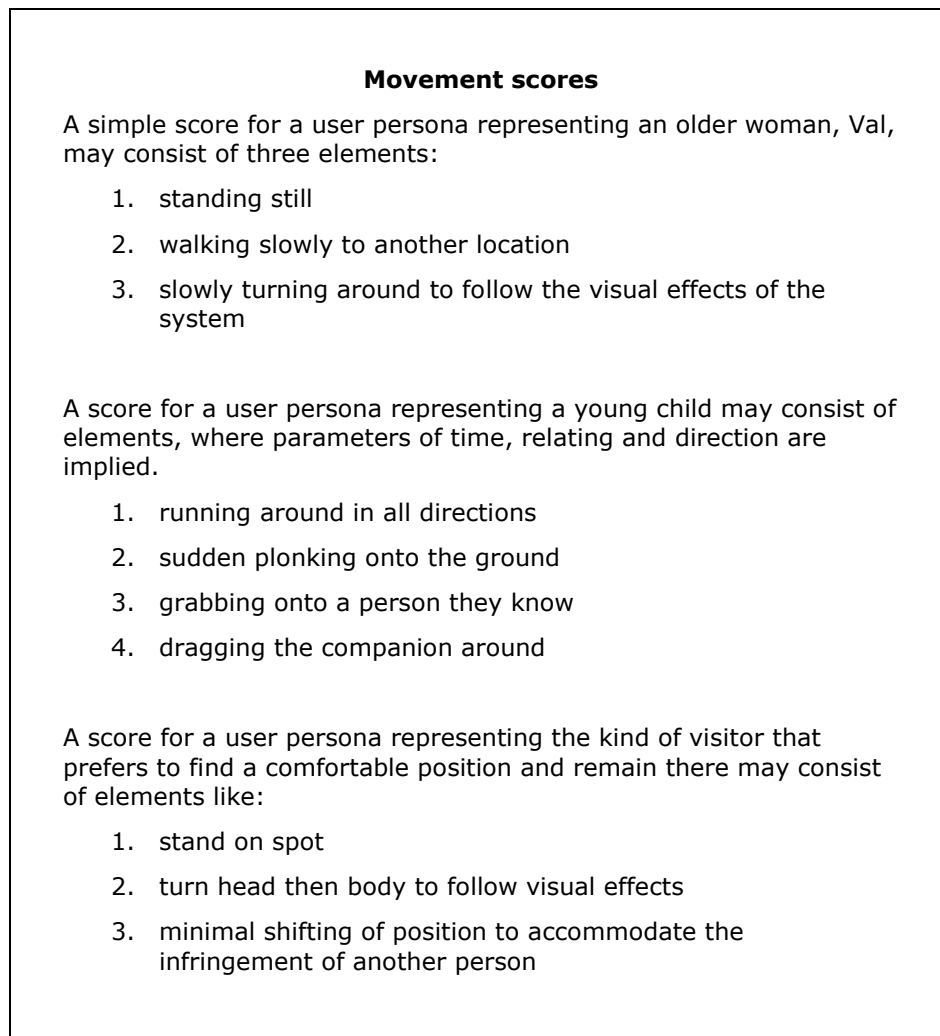


Figure 9.21 Examples of three movement scores for an interactive, immersive space like Bystander

Related work

- *Role-playing and acting out*: Brandt and Grunnet (2000), Buchenau and Suri (2000), Burns et al. (1994), Ehn and Sjögren (1992), Howard et al. (2002), Iacucci et al. (2002), Iacucci and Kuutti (2002), Iacucci et al. (2005), Kuutti et al. (2002), Oulasvirta et al. (2003), Sato and Salvador (1999), Svanæs and Seland (2004)

9.3.6 Visual analysis and representation of moving bodies

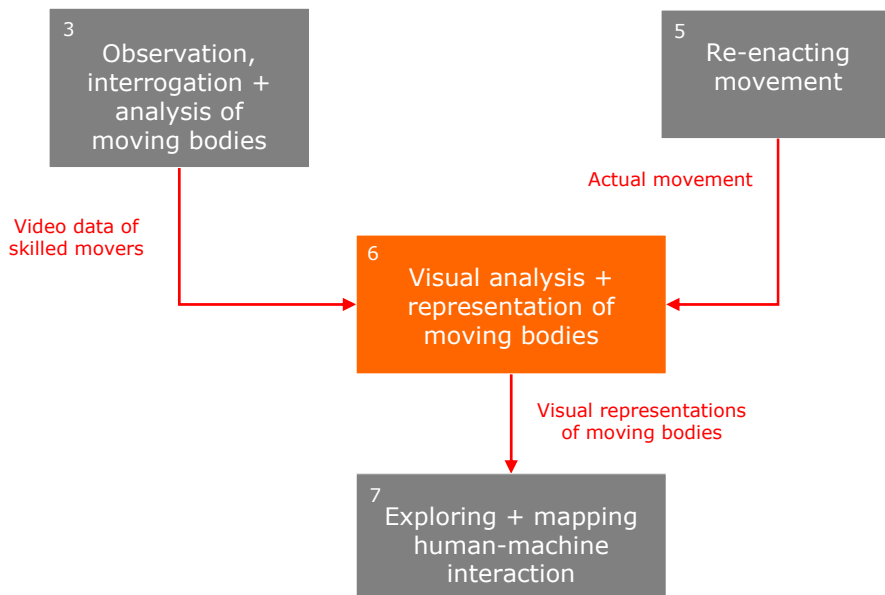


Figure 9.22 The activity of visual analysis and representation of moving bodies and its place in the methodology

Visual representations of the moving body enable closer examination of the moving body from an external or machine perspective. The data gained from this kind of inspection can assist with the design of machine interpretations of the input and bridge the interface between human-centred design approaches and technologically-driven implementations (see Figure 9.22).

The assumption here is that video sensor technology is used for input of human movement. The visual data can be analysed to identify the changing spatial shapes, positions and trajectories of moving bodies and the relation to other bodies and the external environment. The tools presented here include movement sequences, silhouettes, shape analysis using Laban Shape categories and spatial movement schemas in Labanotation.

These tools provide a rudimentary baseline of visual representations of the moving body. These visual representations can be transformed in many ways to bring out different aspects of the moving body in space and time.

They can be used as resources for the design of machine interpretations of the moving body and for computerised motion analysis.

Movement sequences and silhouettes

Movement sequences extracted from video data focus on the key postures and organisation of the body through its trajectory in space and time. The movement sequence can be presented in a number of formats to provide different kinds of information and emphasis. They assist in analysing the mechanics of the body movement in relation to the environment. The movement sequence can be transformed into a sequence of silhouettes of the body. These silhouettes highlight the changing spatial shapes made by the body as it moves through a trajectory. The dynamically changing spatial shaping of a movement can be analysed with Laban Shape categories, describing the static form and the changing relation of the body to itself and the environment. From these movement sequences, a range of other data can be derived such as the changing position of the body and its parts, the trajectory of the moving body, the use of space, timing and rhythm.

An example of a series of silhouettes for the moving body in the act of falling, taken from Project III, is given in Figure 9.23. It shows the mapping or tracking of body parts over the trajectory of the fall. The changing positions of the head, centre of torso and feet are shown for participant 4. In this representation, each snapshot in time is spread out spatially so the body and any overlaid data can be clearly seen at that instant. The shade of grey deepens over time to indicate the progression of the movement. In Figure 9.24, the Laban Effort-Shape description for the movement sequence is depicted.

Spatial movement schemas

Spatial movement schemas are visual representations of spatial paths of individual or multiple people moving through a space. They can be drawn informally or using Labanotation symbols for group choreography (Hutchinson, 1977). Using Labanotation symbols, the position, direction, path and

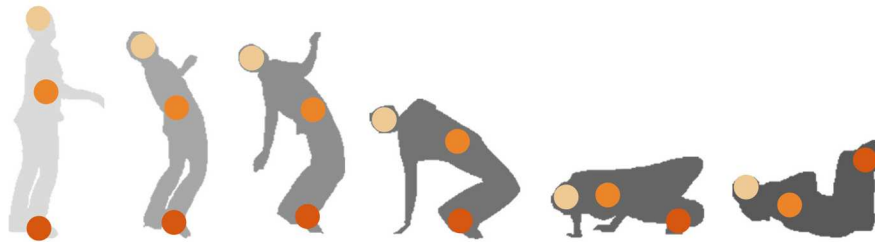


Figure 9.23 Mapping of changing positions of the head, centre of torso and feet for participant 4. The changing spatial shaping of the body is presented in its trajectory through space and time.

Effort Indirect in Space, Sustained in Time, Light in Weight, Bound in Flow



Shape Form

pin-like arc-like

screw-like

Shape Quality

sinking, retreating, spreading

enclosing, then rising

Figure 9.24 Effort-Shape description for participant 4

sequencing of multiple bodies can be visually represented.

An example of a spatial movement schema from Project II (Bystander) is given in Figure 9.25. A detailed explanation of the schema is given in section 6.2.4.

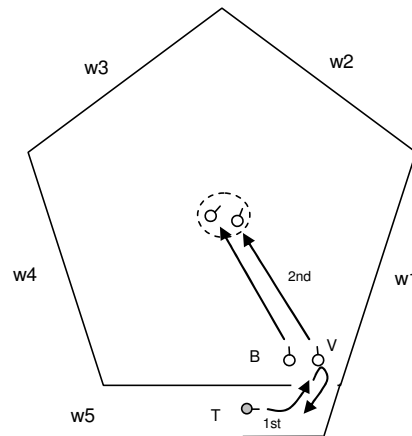


Figure 9.25 Spatial movement schema 2

Related work

- *Visual representations of moving bodies*: Badler and Smoliar (1979), Buur and Soendergaard (2000), Buur et al. (2000), Camurri et al. (2000, 2003a,b), Chi et al. (2000), Hachimura et al. (2005), Høysniemi and Hämäläinen (2004), Muybridge (1984), Zhao (2001)
- *Movement notations*: Guest (1984, 1989), Hutchinson (1977)

9.3.7 Exploring and mapping human-machine interaction

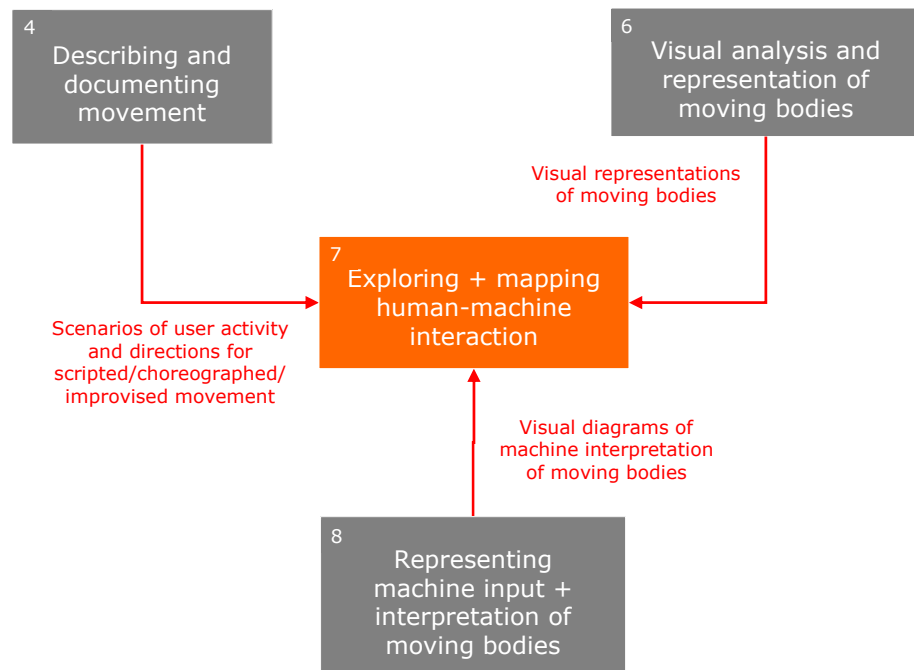


Figure 9.26 The activity of exploring and mapping human-machine interaction and its place in the methodology

When designing an interactive system, one of the core activities is exploring and mapping the interaction between humans and machine (see Figure 9.26). For movement-based interactive, immersive spaces, the focus is on mapping between human movements and the sensing of those movements by the machine and its subsequent response. This is the essence of HCI, originally referred to in the Introduction as an input-processing-output loop. A model of action and perception for both human and machine in the interaction is utilised here, as illustrated in Figure 9.27. This model is embodied in the design tool known as the *Moving-Sensing schema*.

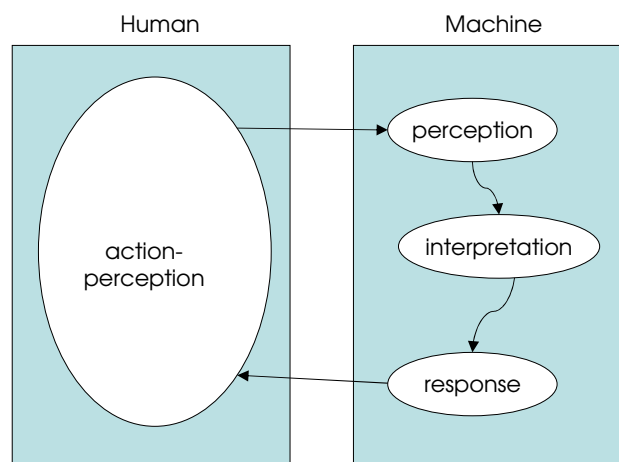


Figure 9.27 Diagram of model of action and perception for human and machine

Moving-Sensing schema

The *Moving-Sensing schema* presents the interaction between user and machine from the perspectives of the user and the machine. It is an integrating representation, as it brings together the various activities and tools that are more or less human or machine focused—this is illustrated in Figure 9.28.

Tools for representing human activity and movement include movement-oriented scenarios, movement scores and choreographic directions. Tools for representing machine behaviour include the breakdown of machine behaviour into input, output and processing. Machine input schemas are used to visually represent the input mechanisms and corresponding interpretation of the input (see also section 9.3.8). The machine input schemas rely on the visual analysis and representation of moving bodies, where actual movement is provided by enactment of scripted movement.

The *Moving-Sensing schema* is an adaptation of Suchman’s (1987) analytic framework, which hinges on the notion of resources available for perception and action by human and machine. The *Moving-Sensing schema* can be organised in a flexible way to enable documentation of user activity in terms of action/movement and perception (internal/external), alongside machine interpretation and response. It makes explicit the links between particular human actions or patterns of activity in an interactive space and

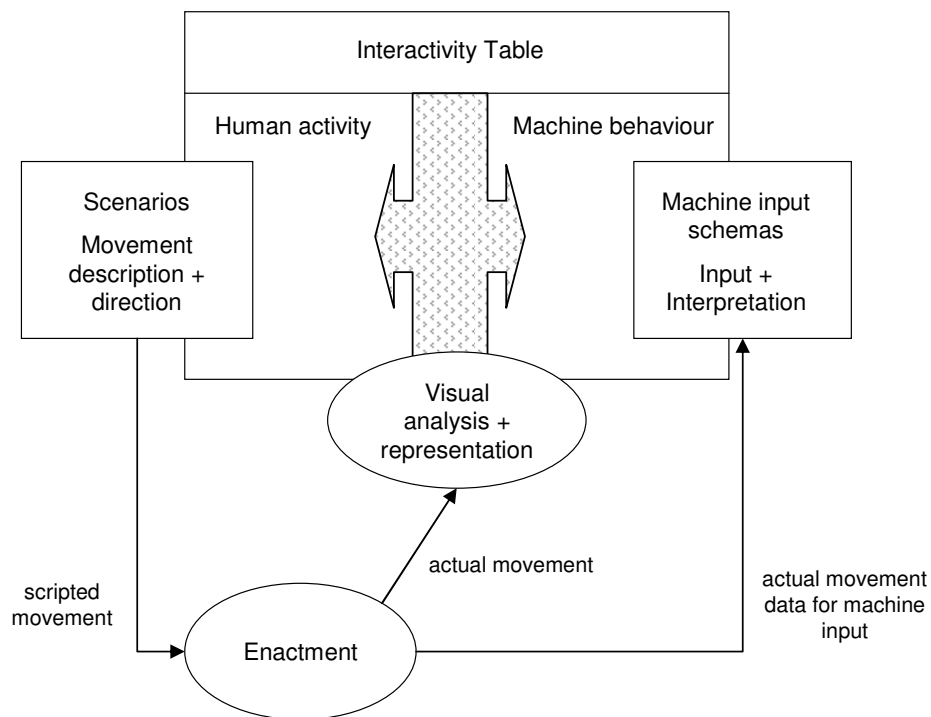


Figure 9.28 Diagram illustrating how the Moving-Sensing schema brings together various activities and tools. The ovals represent activities and the rectangles represent design tools or representations.

The User			The Machine	
Actions not available to the machine		Actions available to the machine	Effects available to the user	Design rationale
User activity/action	Movement description	Motion detection via video camera	Output: Visual display and audio	Game context

Figure 9.29 Suchman’s analytic framework adapted specifically for Project I (Eyetoym)

the corresponding machine behaviour. It enables designers to explore, reason about, evaluate and refine the design of the interactivity between the active, moving bodies of human users and computer-based interactive systems using human movement as direct input. It makes explicit any design assumptions about user behaviour that become embedded in computer-based interactive systems. In this research, the focus has been on interactive, immersive spaces that have visual and sonic outputs to manifest the behaviour of the system. However the design tool can be applied to other kinds of interactive systems such as robots, which may use computer vision to sense human movement and respond with their own programmed movements (Davis and Horaud, 2003; Hachimura et al., 2005).

Examples of Suchman’s analytic framework adapted specifically for Project I (Eyetoym) and as the *Interactivity table* for Project II (Bystander) are provided in Figure 9.29 and Figure 9.30, respectively. In Eyetoym, the framework was used to analyse the movements of the player interacting with the Eyetoym games. In Bystander, the framework was adapted and used as a design tool to explore and map the movements of the audience in relation to the machine behaviour.

Related work

- *Frameworks for interaction analysis and design*: Bellotti et al. (2002), Benford et al. (2005), Bongers and van der Veer (2007), Eriksson et al. (2007), Hornecker and Buur (2006), Rogers and Muller (2003), Suchman (1987)

The User			The Machine		
Actions not available to the machine		Actions available to the machine	Effects available to the user	Internal machine behaviour not available to the user	
Scenario and Key Events	User Perception	User Activity: Movement/Stillness	Machine Effects (Audiovisual)	Machine State	Machine Perception

Figure 9.30 Suchman’s analytic framework adapted as the *interactivity table* specifically for Project II (Bystander)

9.3.8 Representing machine input and interpretation of moving bodies

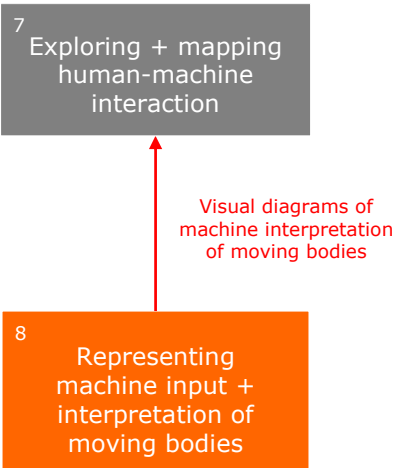


Figure 9.31 The activity of representing machine input and interpretation of moving bodies and its place in the methodology

The machine interpretation of the input depends on the specific application and the sensor technology employed. For video-based sensors, the input is dynamic visual data of moving bodies, which can be broken down frame by frame. Designing the machine interpretation of the input rests on conceptual decisions about how to interpret moving bodies in the system under design. Visual representations of the machine input and interpretation can be constructed to assist in the mapping of human activity/movement in relation to machine behaviour (see Figure 9.31). One specific representation used in this research is the *machine input schema*.

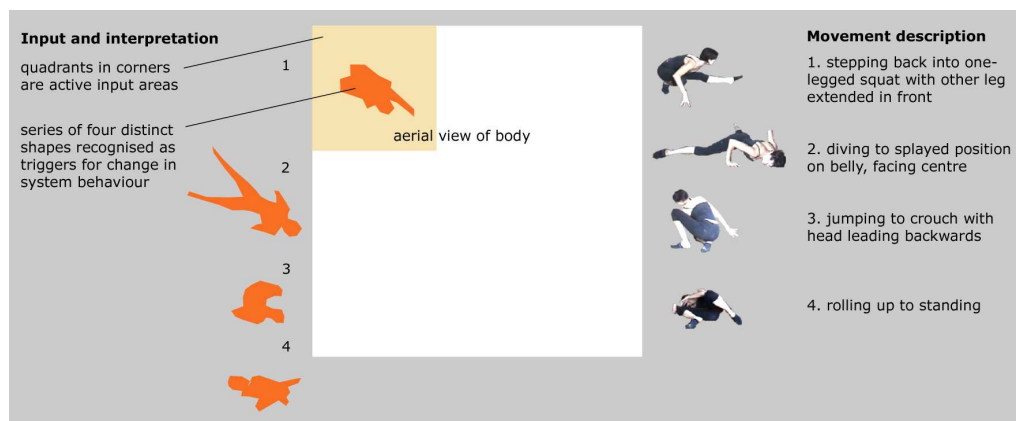


Figure 9.32 Machine input schema from Project III showing the choice of machine input and interpretation for a sequence of choreographed movements

Machine input schemas

Diagrams documenting the movements of users, such as the spatial movement schema diagrams or movement sequences, can be annotated or overlaid with interactive options, detailing the choice of input mechanism, interpretation of the input and corresponding system response. A series of these machine input schemas may be required if longer temporal and dynamic patterns of movement are to be recognised. For example, identifiable patterns of movement could be clustering and dispersion of bodies, periods of relative stillness, straight-line trajectories, slow-moving or fast-moving bodies, textures and rhythms.

An example of a machine input schema from Project III is given in Figure 9.32. The choice of machine input and interpretation of moving bodies in this case is the recognition of a series of four distinct spatial shapes of the body-in-motion within a nominated quadrant of the physical space, which then triggers certain effects such as changing visual imagery.

Related work

- *Digital representations of human motion*: Aggarwal and Cai (1999), Badler and Smoliar (1979), Camurri et al. (2000, 2003a,b), Davis and Horaud (2003), Gavrilu (1997), Pers et al. (2003), Pinhanez (1999),

Wang et al. (2003)

- *Sensors*: Bellotti et al. (2002), Michahelles and Schiele (2003), Rogers and Muller (2003)

9.4 Summary—A Design Methodology of Moving and Making Strange

The design methodology of Moving and Making Strange is motivated by a spirit of inquiry into the experiential, moving body. In the design of interactive, immersive spaces and other movement-based interactive technologies, the design methodology offers methods and tools for use at different stages of the design process. There are methods and tools for investigating movement through practices of *making strange* with the moving body and for inventing and choreographing movement. There are methods and tools for observing and analysing human movement from an experiential perspective and an observational perspective. There are methods and tools for describing and documenting movement and re-enacting movement. There are methods and tools for visually analysing and representing movement, exploring and mapping human-machine interactivity and representing machine input and interpretation of moving bodies.

The methodology includes the two major strands of investigation running through this thesis—the Laban system of movement analysis and Labanotation and Suchman’s analytic framework adapted as a design tool. The part of the methodology for *representing* movement is contingent on the specific sensor technologies employed for sensing movement. The kinds of visual representations of moving bodies depicted in the methodology are strongly related to the use of video-based motion-sensing technologies for input of human movement. The use of other kinds of sensors such as pressure mats, lasers, ultrasound, etc. would require different forms of visual representation.

This methodology enables designers to shift between the different, multiple perspectives of the first-person experiential, the observational and the machine, depending on which method/tool is being employed. The first-

person experiential perspective ensures designers are accountable to the lived experience of the mover and to potential users of technology. It develops a designer's abilities and sensibilities to work with the moving body as a design material and to access the creative potential of the moving body. It contributes to a designer's embodied intuitions for working with movement and its felt experience in the generation and evaluation of design concepts, prototypes and final systems.

The observational perspective ensures accountability to the external point of view of the observer, to what the moving body presents to the outside. Three of the five conceptions of movement presented in Chapter 3 offer various interpretations of the moving body. Movements of the body can be interpreted from the outside as physical movements, as individual or cultural expression or as communicative acts. The moving body can be considered in the sociocultural frame of patterns of social and spatial interaction between people and the patterns of meaning in structured movement systems.

The machine perspective ensures designers are accountable to the machine view of the movements of users and that appropriate mappings are made between user activity and machine interpretation and response. The representations constructed from both the observational and machine perspectives can act as boundary objects (Star, 1990) or bridging representations between the movements of users and the input and interpretation of those movements by the machine.