Chapter 7

Project III. Falling into Dance

The third project continues previous work, with the aim of validating and extending the findings from the first two projects. One of the primary motivations was to extend the range and kinds of movement to be sensed, from everyday movement (in Bystander) and limited range of arm gestures (in Eyetoy) to more heightened and choreographed forms of movement. More complex forms of movement were examined, such as the action of falling and choreographed phrases of movement.

The primary aim of the third project was achieved through a *constructed design situation*, using a hypothetical, future system as a vehicle for further exploring how movement could be understood, described, represented, experienced and enacted in the design of such movement-based interactive systems. Unlike the second project, Bystander, there was no readily available design project in which to situate this work. Creating a constructed design situation enabled prolonged attention to and visibility of the design artefacts and their transformations throughout the project.

I chose to work with trained dancers and physical performers for their expertise in using the moving body as a design material (Schön, 1987). I saw the practices of dance, movement improvisation and choreography as a rich source of potential methods and tools that could be reapplied in this field of movement-based interaction design. A series of studies was undertaken to trial and identify a range of methods and tools for working with the moving

body.

The first study was of the *falling* body by skilled movers. What is it to fall? The action of falling is a common occurrence in our movement patterns as children, but over time recedes from the movement repertoire of most adults, returning when we are old. We can take the action of falling for the purposes of 'making strange', moving into unfamiliar territory, stretching our everyday range of movement and experiencing a new, or revitalising an old, movement pattern and pathway. Using accounts of falling by skilled movers, we can question and re-examine our usual, everyday conceptions of falling. Skilled movers function as the ethnographic 'exotic'. New insights and understandings about the moving body in the act of falling can stimulate design concepts for new forms of movement-based interaction. Another motivation for studying the act of falling is that it is not part of the established movement lexicon in digital praxis. This makes it open for investigation, unlike gestural actions such as pointing and grasping, which are well known and researched in human-computer interaction and virtual reality (Poupyrev, Billinghurst, Weghorst, and Ichikawa, 1996; Bowman and Hodges, 1997; Pavlovic et al., 1997; Badler et al., 2000; Schiphorst et al., 2002; Brereton et al., 2003; Fagerberg et al., 2003; Kirk et al., 2005). Other kinds of movements could have been selected for the study and served the same purpose. The choice of falling is thus representative of other kinds of actions that can be sensed by a computer.

The aim of the study was to explore the act of falling from a first-person, experiential perspective *and* from an external, observational perspective, corresponding to that of the machine. Together the two accounts produce an understanding and description of the moving body in the act of falling that can act as a foundation for subsequent design work. The analysis generated a range of different descriptions and representations of the falling body. These included, from a first-person experiential perspective, accounts of the process and experience of falling and characteristic components of movement for describing the act of falling and from an external, observational perspective, movement sequences of the moving body, silhouettes of changing spatial shapes of the moving body and Laban Effort-Shape descriptions of

the qualitative, dynamic character of the movement.

The second study explored ways of generating and choreographing movement. Methods that dancers, trained in movement improvisation and performance making, used to generate, devise and document movement were examined as sources of potential methods for technology designers. Spatial movement schemas (using Labanotation floor plans) and machine input schemas were trialled as tools for representing the movement choreography and corresponding interactive treatment, respectively. The results from this study contributed to a set of methods and tools for working with the moving body. These included methods for generating and choreographing movement and tools for describing and representing movement. The methods for generating and choreographing movement included scoring techniques from movement improvisation practices, working from image and text and working with parameters of speed, scale and direction. The tools for describing and representing movement included textual descriptions of movement motivation and choreography, visual representations of the choreographed movements in Labanotation, sequences of motion stills and Laban Effort-Shape analysis.

7.1 Study I—The falling body

This study examined the act of falling as a specific form of movement that is on the periphery of our everyday realm of movement and has a complex changing form through space and time. Interviews and physical demonstrations were conducted with trained dancers and physical performers to examine the process and felt experience of falling. These sessions were filmed on digital video tape and also recorded with a digital audio recorder for transcription purposes. The video footage and audio recordings were utilised as records of the session for later iterative analysis. Analysis was performed on the raw data from two perspectives—an experiential perspective and an external or machine perspective. The analysis generated a range of different descriptions and representations of the falling body. These included first-person accounts of the process and experience of falling, characteristic components of movement for describing the act of falling from an experiential

perspective, movement sequences of the moving body, silhouettes of changing spatial shapes of the moving body, and Laban Effort-Shape descriptions of the qualitative, dynamic character of the movement. This set of descriptions and representations can be extended to any movement, not just falling. The results of the analysis are described in more detail below.

7.1.1 Interviews and physical demonstrations

Interviews and physical demonstrations were conducted with a set of eight participants. There were six female and two male participants. All participants were trained as dancers or physical performers in a range of dance and movement practices including acrobatics, butoh, contemporary dance, stilt-walking, physical theatre, Feldenkrais and improvisation. Each participant took part in a half-hour session that required them to physically demonstrate acts of falling using the bodily techniques in which they were trained. During this session, they were interviewed about the act of falling, specifically to determine the techniques for falling, the sensation of falling and how it fits into their practice, both in training and in performance.

Participants undertook their own warm-up prior to the demonstration. Each session began with the participants improvising their own movement and initiating acts of falling to the ground. After a few minutes, the interview began with the researcher asking questions and prompting clarification. Participants would answer verbally and quite often begin to move again to demonstrate aspects of the action/process of falling.

Accessing in-the-moment sensations

The participants would often repeat the action of falling to access in-the-moment sensations and to pay conscious attention to what they were doing while falling. Here is an example from participant 2's explanation. The text, in square brackets, describes the actual physical actions executed by the participant.

> But if you have energy that is going downwards—one way to get down, like another thing that might be interesting is falling into a roll, [falls

> into a roll] because then you actually kind of distribute the energy differently. Does that make sense? So even—something like—[falls backwards and rolls] that's actually ... because the energy becomes something else, I'm using the momentum, it actually sort of softens it ... that was probably more comfortable then. Or if I go [falls], it just sort of—if I try to stop it, like if I let myself splat, then I've got to stop the energy. And I guess that's also what I'm doing when I'm going in the other direction, I'm minimising the amount of force, by thinking that way—it's working against gravity, breaking up the amount of energy that's going to the ground, or something. I'm not sure.

For this particular participant, more awareness and insight into his process and sensation of falling were acquired as he continued to experiment with different ways of falling. He began the session by simply moving around and falling, without any conscious thought about how to do it, as evidenced in this quote.

> When I'm doing it I don't really think at all. I don't really go okay I'm making my body do this and this and this. I learnt how to do it and the patterning in my body is already geared towards certain things, that I know will make me feel comfortable or safe.

As the session continued, he was able to give more precise descriptions of his movement process, techniques and felt sensations. This was the case for most of the participants, with the exception of one professional dancer for whom verbal articulation of her technique became less accessible as the session progressed.

Learning a Technique

Some participants instructed one of the researchers in learning a given technique. This was done to gain more insight into breaking down the technique and to acquire a bodily understanding by the researcher. Here is an example of participant 8 teaching the technique of a shoulder roll.

So, the first thing is, if we just start like this [sitting on floor with legs stretched out in front]. So this is what we call a shoulder roll. So you can go either way. So what I'm going to do is—just have a look first. I'm going to put my arm out like this [right arm out to shoulder height], and turn my head that way [head turned to left and down], having a look at my left knee [rolls backward over right shoulder]. Look at my left knee—that's it. And back that way. [rolls forward over right shoulder]

So basically once you learn this, you can take it into a full run backwards. And you can go either way—if you feel more comfortable that way [rolls backward over left shoulder]. So, the thing about this technique, which is great, is that the back of the head—you avoid the back of the head on the floor [slaps floor]. It means you can roll at a great pace, without clunking your head. If you do a backward roll, it's very difficult—a straight backward roll, it's very difficult not to clunk your head.

Okay, let's go. This arm [right] goes out to the side, and this one kind of comes round like this—you look at your knee, you roll over. Go from sitting. And we'll go like this [rocks back with knees bent], and you can bend your knees. You can use that momentum. You're going to look at your left knee. [Researcher rolls back] Look at your left knee. Yep, that's it. Good. Try it again. So basically you just want to do that [tilts head down to left side]. The head sort of touches, but it's not clunking at all. I'm just using this [taps knee] as a guide. You can actually just look straight ahead. But then, at the last minute ... I'm actually looking that way.

So what we could do next, is go from standing. We're just going to take one step back like this [lowers to floor with right knee bent], put our hands down [on floor by side of hips], and then go over onto the knees, and push off the floor up to stand. That's it. Once we get that kind of smooth, we can start to do it from a walk. And eventually we could take it into running backwards. You can use a shoulder roll to come out of all kinds of fast-moving falls.

This excerpt illustrates the breakdown of the technique into a sequence of preparatory exercises. With learning to fall, one commonly starts on the ground and then works back up to initiate the fall from standing. In order to fall safely, we need to first establish familiarity with contacting the ground. After that we learn how to resolve the trajectory of the fall into the ground. Once this is achieved, we can then begin to execute the technique more freely in different situations. As participant 8 demonstrates here, this technique can be done from walking or running backwards.

7.1.2 Analysis from the experiential perspective

The raw data was transformed and analysed to gain an understanding of the act of falling as experienced by the people performing the movement. Written transcriptions of the interviews were taken from the audio/video records. The video footage was edited to produce a summary of each participant's demonstration and explanation of falling. These *video summaries* were useful for returning to a dynamic, visual replay of a particular participant's way of falling and function like selected transcripts as described by Jordan and Henderson (1995) in the use of video data for interaction analysis. The data was then analysed to produce two forms of experientially-based descriptions of the act of falling—first-person experiential accounts and a summary of participant descriptions organised into characteristic components of movement.

First-person experiential accounts

The written transcriptions were edited into a more compact form, termed a *first-person experiential account*. The first-person experiential accounts were reviewed with participants in a follow-up session to ensure that they were a faithful record and representation of their understanding of falling. Figure 7.1 contains a sample of excerpts from verbatim transcripts. The first-person experiential accounts and the video summaries fed into the next activity of analysing the salient aspects of the act of falling.

Participant 3. There's certainly a sense of great release in the upper body, as long as I have a basic arrangement of landing here and shooting out. (Be)cause I notice with this side, I think there are complications with falling first [slaps left thigh], so this [left arm pointing out to left and jabbing] - the order of things. There's also a lot of - I'm feeling fear, about doing it, I mean not great fear, but just enough to be kind of hesitant. You can't afford to be hesitant if you're going to be falling, I guess.
Participant 4. On a mechanical level, I guess I kind of take into awareness where my head is in relation to the rest of me. And I find that equilibrium with my head first I think. And then, in the act of falling, there's a relationship between where my head is and my pelvis, and my head and my feet, so that by finding a way where they can be in some kind of alignment I save myself. So I'm always kind of mapping where I am. As I'm going down, I let the legs and the arms catch some aspect and then, the passage into the floor is dispersed through the body.
Participant 6. It's an image of extension and then release, tension release. There's an idea of a, almost like a hook, or a long string from the clouds, at the head. And then it's been cut. And then the head is being pulled back up again. The cut gives that real weight to the body ... it becomes - an impact ... the most important thing is to have that image, so then you're imagining, if that's cut then it's a crumpling.
Participant 7. 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 8. Going off-centre (is the stimulus), which is something. Always finding in different situations of your movement, where you can find an off-centre moment, I suppose. And I guess talking about off-centre, it's like finding interesting configurations. Like before when I was collapsing, I could collapse by degrees. I'm actually just collapsing by small bits, as opposed to a big drop. And what I'm looking for when I'm doing it, is interesting configurations, that surprise me. What I find interesting, that's interesting [as he collapses incrementally]. And then, playing with the dynamics, I might, so how can I get from here up to standing, quickly or ...

Figure 7.1 First-person experiential accounts of falling

Characteristic components of describing the act of falling

Both the original footage and the summary videos were viewed multiple times to identify the salient aspects of the act of falling as experienced by the participants. Phrases uttered by the participants themselves were selected from the transcripts. These phrases reflected each participant's individual ways of articulating their understanding of their own movement processes. These phrases were then grouped into three characteristic components of movement, as defined below.

- *Movement process and technique*: The process of the movement and the technique for performing the movement are inter-related. 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. Technique is an established means for directing or informing the movement process.

- *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.

- *Felt quality*: the particular sensation or feeling as experienced in the whole or part of the body.

Each of these characteristic components will be elucidated with examples from the participants in relation to the act of falling.

Movement Process and Technique. The movement can be analysed as a process of the body changing relationally in space and time. This movement process can be broken down into a series of distinct stages, which are dependent on the particular movement being analysed. For falling, there are three distinct stages in the process of falling—initiating the fall, descending and contacting the ground. The technique for informing or directing the movement process is an intrinsic part of the performance of the movement.

There is a range of techniques, peculiar to the act of falling, for initiating the fall, controlling the descent and contacting the ground safely. These

techniques can be broadly categorised as being mechanically based or image based. In mechanically based techniques, the focus and emphasis are on the order, organisation and sequencing of body parts in relation to each other and the environment as the movement unfolds. However, the conscious focus on the detailed mechanics of the movement lessens as the technique is mastered. As participant 8 explains, you "give over the rational; technique goes into automatic pilot."

Here are some examples of this category of technique for the three stages of falling. Participant 8 goes off-centre to initiate the fall, whereas participant 1 drops her weight vertically down to the ground. Participant 4 uses an internal muscular lift to slow down the descent and participant 1 controls the slide out to the side by extending the other arm away from the direction in which she is moving. Participant 2 contacts the ground safely by making the contact with the ground take the greatest amount of time and cover the greatest surface area of the body, whereas participant 3 releases any tension and softens into the floor. In general, all participants worked with softening into the ground as they landed.

In image based techniques, the focus and emphasis is on working strongly with the image to direct and inform the movement process. If you surrender fully to the image, the body follows. There is less attention given to specific body parts moving in a certain order. Participants 6 and 7 use the image of a string being cut from the crown of the head to initiate the fall and the image of the body as a bag of bones to descend and contact the ground. A different example is of participant 5's use of the image of being pushed purely to initiate the falling.

Sensing and Awareness—Internal and External. This characteristic component refers to the active sensing and awareness of one's body in relation to itself and to the external environment. The visual, aural, tactile, and proprioceptive/kinaesthetic senses are included here, but not taste and smell as they were not mentioned by any of the participants in this study. In regard to falling, it was interesting to tease out the relationship between the visual and kinaesthetic senses and to understand how they were utilised in the act of falling.

Protecting the head is crucial when falling. Looking at participant 4's first-person experiential account (see Figure 7.1), we can see that she is constantly mapping where her body is in internal relationship to itself. She first ascertains where her head is in relation to the rest of her body and then maps where her pelvis and feet are in relation to her head. In the act of falling, we draw continuously on our kinaesthetic sensing to know what the body is doing and how it is aligned at any particular moment.

The visual sense is predominantly used to check where one is in the space and in relation to others. The awareness of the external environment is reliant primarily on the visual sense. Participant 6 explains that "Visual sensing keeps me aware of the outside, otherwise I can become too internal". Participant 8 explains, "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." The two senses work together to provide an ongoing awareness of the internal relations and state of one's body in relation to the external environment.

Felt Quality. The felt quality of the movement refers to the sensation or feeling in the body. It is an inextricable part of any movement. It may be informed by the kinaesthetic sense; the sense that governs our self-perception of movement (Sheets-Johnstone, 1999a). Looking at an excerpt from participant 2's account, he separates out the felt quality of the *descent* from the felt quality of the *landing*. The text in italics indicates the descriptions of the felt quality.

> It's hard now ... but I'm trying to think about it before we started chatting, about what that feeling was ... *it feels very free* ... it feels like my body, *I'm letting go, I'm releasing*, I'm letting go of my body, I'm releasing my body, first from my leg I guess and then—the way I think about it is, I guess my head sort of feels like it's, I'm not holding my head or anything, it feels very much like it's, *like I'm a rag doll* or something. So it's just a release, and just release my body into the ground, sort of thing. And with that, the feelings that I kind of get aren't really emotive, but they're—oh, I'm trying to separate out the experience of actually doing it, the actual falling, 'cause once you've

> landed it's slightly different. And the feeling actually in the moment of falling is quite a—yeah you'd probably say it is *exhilarating*, but it's so quick. It's over in less than a second that I get more caught up in the actual—the landing. And the *clunkiness* of that [laughter]. So the experience of actually hitting the ground, that's not exhilarating! [laughter] That's something else.

Participant 3 provides a different account of the felt quality in the act of falling. For her it is a feeling of "suspension and precariousness, teetering over the edge—dissolving into that."

Figure 7.2, Figure 7.3 and Figure 7.4 present the range of participant descriptions of falling, sifted and organised into the three characteristic components of movement. They provide a condensed summary of the aspects of falling, as described by the participants themselves. What this analysis reveals is a diverse range of understandings of the process and experience of falling for these eight participants.

7.1.3 Analysis from the external or machine perspective

When considering the action of falling as input to a video-based motion sensor, it can be modelled and analysed from an *external* or *machine* perspective in many ways. A rudimentary baseline of representations of the falling body is presented to which more abstract and complex transformations can be applied.

Movement sequences were extracted from the video footage of each participant performing a particular instance of falling. These movement sequences allowed a closer analysis of the moving body in its trajectory through space/time. They were annotated with descriptions of the process and technique of falling. The movement sequences for participant 1 and participant 4 are shown in Figure 7.5 and Figure 7.6, respectively. The time between each image or snapshot in the sequence is 0.4 seconds.

A series of silhouettes was made from these movement sequences to draw out the spatial shaping of the body for different types of falls (see Figure 7.7

Participant description
Initiating the fall
P4 Finding pathways into the floor
P3 Finding steps to take you off-centre
P1 Momentum of dropping down
P2 I thought "just fall'"
P2 Release from the centre
P5 Like being pushed. An outside force.
P8 Going off-centre
P8 Finding interesting configurations
P1 Toppling like a rock
P6/P7 Image of extension and then release - like a string being cut
Controlling the fall
P4 Internal muscular lift to slow down
P2 Working in opposite direction to the fall
P1 You could even control that more by taking your weight to the opposite side
P8 Finding a way to support yourself down, with your hand
P8 Collapsing by degrees
P7 The cut gives that real weight to the body. Then it's a crumpling.
Contacting the ground
P3 Bodily technique is release on the floor
P2 An unfolding. Letting my body roll into the ground
P2 Relax and soften
P2 Making the contact with the ground take the greatest amount of time and cover the greatest surface area
P6 Different surfaces give different sensibilities
P5 Impetus of falling to the floor, and recovery
P3 Absorbing it in the joints
P3 Distal initiation
P3 The direction that you're moving in kind of pulls you out of just being - what not to do
P4 Let the legs and arms catch some aspect, and then the passage into the floor is dispersed through the body
P8 Rolling down the body
P8 If you don't let go and you've got tension, then you become a body full of angles that are all going to contact the floor and be really clunky
P7 Body is like a bag of bones

Figure 7.2 Characteristic component of movement—movement process/technique—for describing the act of falling, from an experiential perspective. Each description is labelled with an index to the participant, for example, P4 refers to Participant 4.

Participant description
P4 Always mapping where I am
P7 Aware of your body within a larger space
P4 Visual preoccupation can interfere with kinaesthetic sensing
P6 Awareness of others, their rhythms
P6 Visual sensing keeps me aware of the outside, otherwise can become too internal
P8 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

Figure 7.3 Characteristic component of movement—sensing and awareness—for describing the act of falling, from an experiential perspective. Each description is labelled with an index to the participant, for example, P4 refers to Participant 4.

Participant description
P3 Paradox of light and heavy
P3 Suspension and precariousness, teetering over the edge - dissolving into that
P5 Out of surrender
P1 A sensation of falling, but you're in complete control
P6 Sense of suspension
P6 Sense of weight, like a sack of potatoes
P2 Feels exhilarating, then clunky

Figure 7.4 Characteristic component of movement—felt quality—for describing the act of falling, from an experiential perspective. Each description is labelled with an index to the participant, for example, P4 refers to Participant 4.

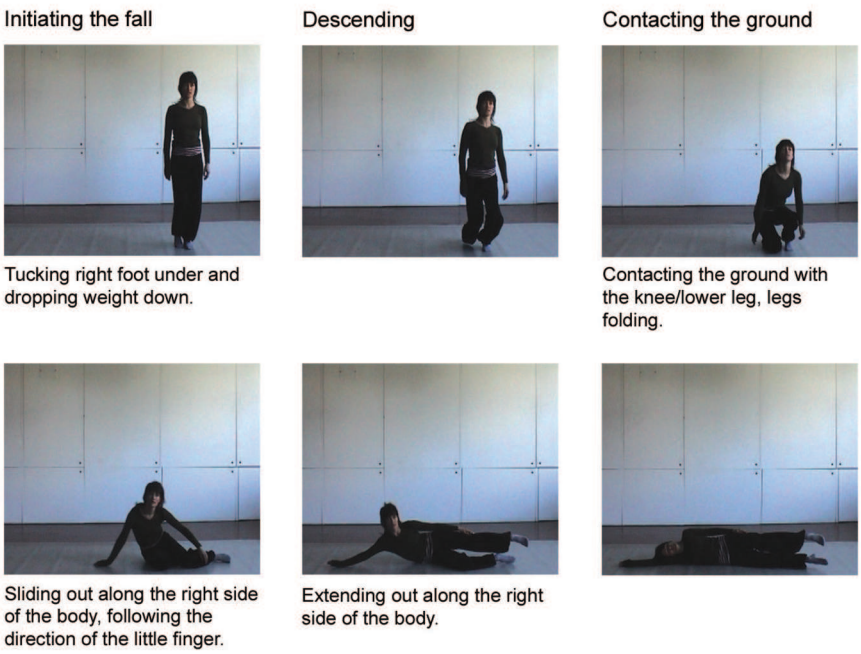

Figure 7.5 Movement sequence for participant 1 in the act of falling, annotated with descriptions of the process and technique of falling

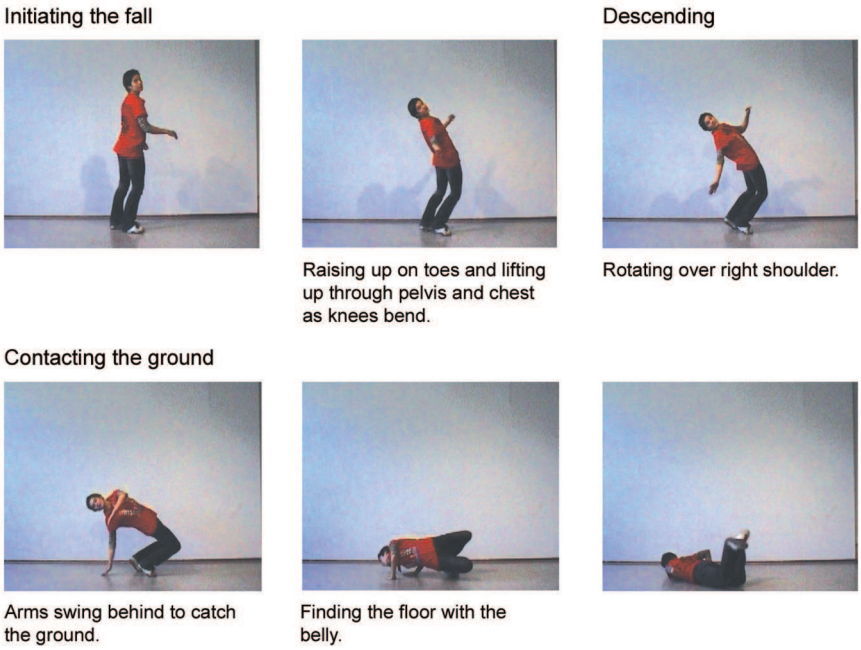

Figure 7.6 Movement sequence for participant 4 in the act of falling, annotated with descriptions of the process and technique of falling

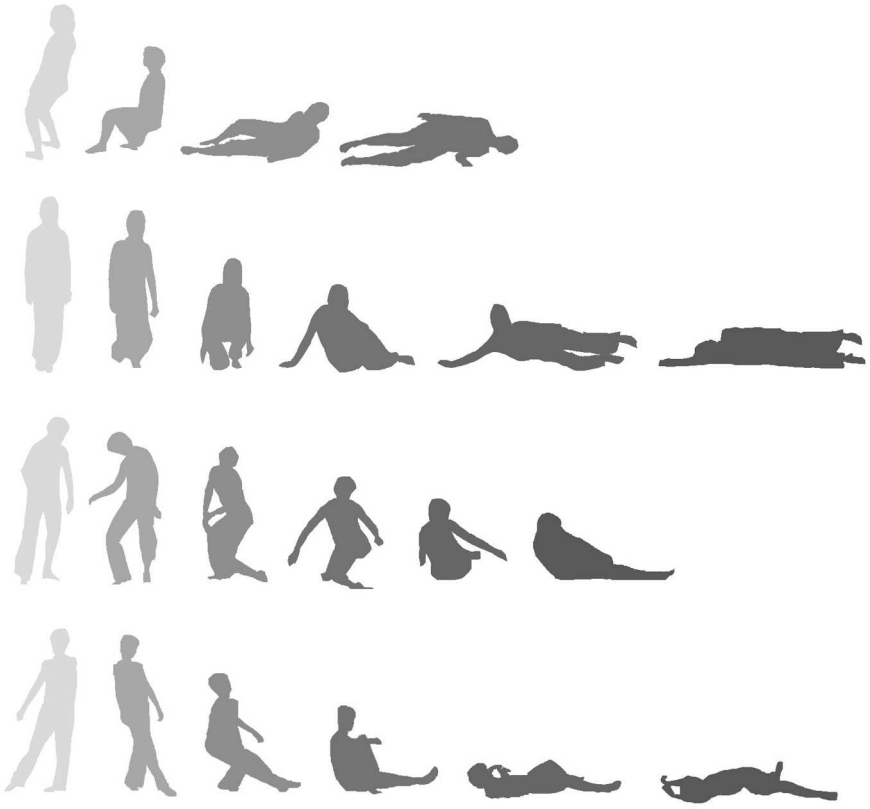

Figure 7.7 Silhouettes of participants falling

for a sample of participants). The intensity of the shading increases as the trajectory of the fall progresses.

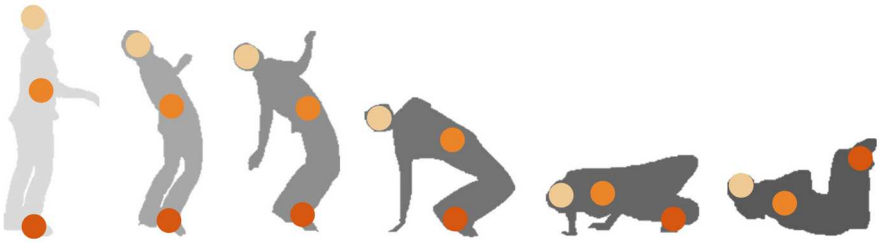

Figure 7.8 Mapping of changing positions of the head, centre of torso and feet for participant 4

From these two representations a range of different parameters can be derived. These parameters include:

- Trajectory of body
- Changing position and relation of body parts along the trajectory
- Distinct types of falls
- Dynamically changing pattern of spatial shaping
- Timing, rhythm
- Qualitative, dynamic character

Figure 7.8 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. As for the movement sequences and silhouettes, each snapshot in time is spread out spatially in the representation so the body and any overlaid data can be clearly seen at that instant.

Figure 7.9 illustrates the dynamically changing pattern of spatial shaping for participant 4, where each snapshot in the sequence is overlaid on the previous one. The shade of grey deepens over time to indicate the progression of the movement.

The qualitative, dynamic character of the movement can be described using the Effort-Shape component of Laban's system of movement analysis. The spatial shaping of the body can be analysed in terms of what forms the body makes and the relation of the body to itself and its environment.

Figure 7.9 Dynamically changing pattern of spatial shaping for participant 4

The following two examples serve to illustrate the application of the Laban Effort-Shape descriptions.

The qualitative, dynamic character of participant 1's fall could be expressed as a sudden, smooth drop and slide, or in more evocative and metaphorical terms, like a stone plummeting and ricocheting. In this instance, the Effort is direct in Space, sudden in Time, free in Flow and strong in Weight for the drop to the ground, then light in Weight for the slide along the ground. The Shape is predominantly pin-like in form as the body begins standing erect and finishes on the ground extended along the central axis of the body. The Shape changes to a semi-contracted, ball-like form in the middle section of the trajectory as the legs fold to enable the descent to the ground. The Shape Quality is sinking during the descent, then spreading during the contact with the ground. See Figure 7.10 for a visual reference to these qualities.

The qualitative, dynamic character of participant 4's fall is suspended and buoyant within a controlled, circular descent. The corresponding Effort is indirect in Space, sustained in Time, light in Weight and bound in Flow. The Shape begins arc-like in form as the body arcs backwards in spinal extension through a curved trajectory towards the ground. It then becomes more screw-like as contact is made with the ground. The Shape Quality is sinking, retreating and spreading in the descent to the ground. As the hands and front of the body contact the ground, the Shape Quality changes

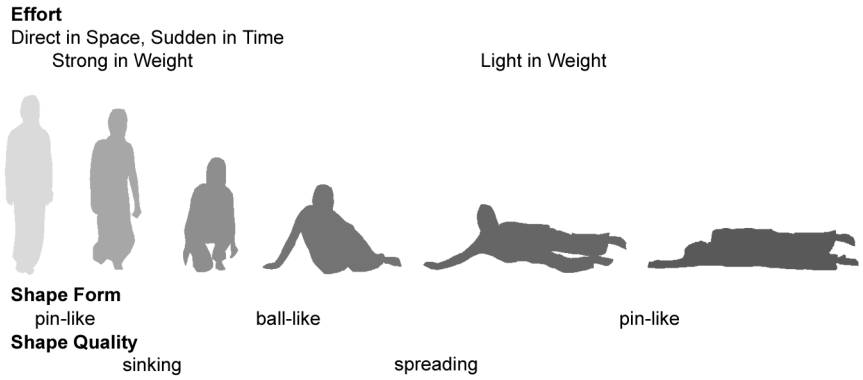

Figure 7.10 Effort-Shape description for participant 1

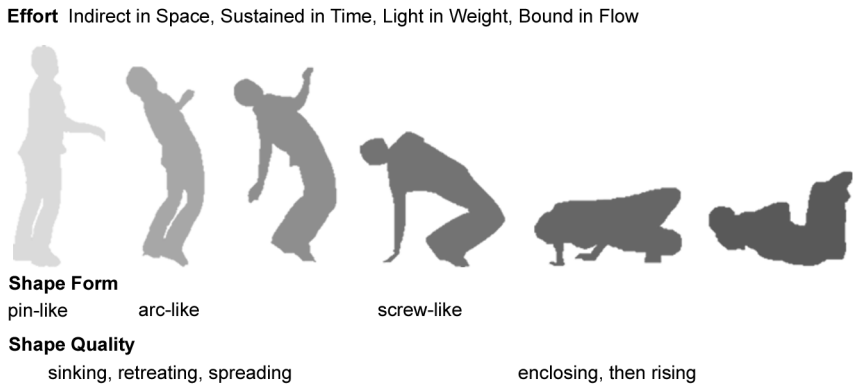

Figure 7.11 Effort-Shape description for participant 4

to enclosing, then rising as the fall is resolved. See Figure 7.11 for a visual reference to these qualities.

With any of this kind of movement analysis, the observation of other's movement is validated or confirmed through an enactment of the same movement by the analyst/researcher, whenever possible. It is not enough to have an intellectual understanding of the process and qualities of movement. This understanding must be complemented with a bodily understanding, which is acquired through actual movement enactment and experimentation.

Computerised motion recognition systems like EyesWeb exist that process the in-coming video stream using algorithms based on Effort-Shape parameters (Camurri et al., 2000, 2003a). The EyesWeb expressive gesture processing library offers modules for motion, space and trajectory analysis

(Camurri et al., 2003b). These kinds of systems are seeking to recognise the more expressive components of human movement. The use of LMA and representations emphasising silhouettes and spatial shaping of the body in this study fits well with this kind of computerised motion recognition system.

7.1.4 Findings

The analysis of the first study generated a range of different descriptions and representations of the falling body. From an experiential perspective, these included first-person accounts of the process and experience of falling and characteristic components of movement for describing the act of falling. The descriptions of the movement process and the felt experience of movement in the act of falling varied considerably across participants. This rich variation suggests unexplored opportunities for accessing the creative potential of the moving body in design work—preliminary exploration was then conducted in the second study.

From an external, observational perspective, these included movement sequences of the moving body, silhouettes of changing spatial shapes of the moving body and Laban Effort-Shape descriptions of the qualitative, dynamic character of the movement. These representations act as a bridge between the movements of people and the formulation of recognition algorithms.

The activities of the study, the data and the results of analysis were examined as sources of methods and tools for potential inclusion in the proposed design methodology of Moving and Making Strange. From this study of falling I identified a range of methods and tools that formed the beginnings of the design methodology. An early version of the methodology was first published in Loke and Robertson (2007). The methodology in its initial form contained two key areas: ways of accessing the experiential, moving body and ways of describing and representing movement. On reflection, a missing part of the methodology was methods for inventing and devising movement. These methods form part of the practices of *making strange* with the moving body. They provide ways of experiencing and exploring movement outside of

the familiar or everyday. The second study in the series addresses this gap in the methodology by exploring ways of choreographing movement for use in the design of movement-based interaction. Choreography is defined here as the activity of generating, devising and documenting movement.

7.2 Study II—Inventing and choreographing movement

The primary aim of the study was to explore ways of inventing and devising movement for use in the design of movement-based interaction, by drawing on the practices of dancers and physical performers trained in movement improvisation and performance-making. A secondary aim of the study was to explore forms of representing the choreographed movements and the corresponding interactive treatments of the movements. I was particularly interested, still, in the act of falling and how it could be utilised both choreographically and interactively in these kinds of spaces. The same motivations hold for using falling, as given in the first study.

Two workshops were conducted with dancers who had previously participated in the study of falling and were trained in movement improvisation and performance-making. The first workshop was conducted with two dancers, Esther and Michael (pseudonyms), to explore the use of falling as input to an interactive space built on motion-sensing technologies.

The first finding from the first workshop was that techniques for generating improvised movement, such as *scoring*, could be useful in design exploration and enactment of movements for use in interactive systems. Scoring 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 of walking, standing still and moving in place. Other parameters of speed, duration, timing, scale, focus, use of space and so on, can be added to the score.

The second finding from the first workshop proved critical to the success of the study. The session failed to produce adequate data for exploring

interactive treatments of choreographed movements and the corresponding representations of both the movements and the machine interpretations of the movements. On reflection, the session was set up with too few contextual constraints for the dancers to work within, resulting in the production of dislocated fragments of choreographed movements that lacked coherency and significance. This highlighted the need for a *specific* and *well-defined context* or *domain* within which to generate meaningful movements, with regard to the *framing* of the activity of inventing and devising movement. This reinforced an earlier finding from Project I, a study of movements performed in interaction with Sony Playstation2© Eyetoy games, where the context of the games enabled people to perform meaningful movements. As a consequence of this finding, an iteration in research design was conducted to try to get the required data, by placing the research within a well-defined domain.

In order to focus specifically on the relation between choreographed movements and machine interpretations of those movements, a constructed design situation was set up involving the initial development of a choreographic work sited within a video-based, motion-sensing interactive space. The system needed to accommodate a range of human movement, from the ordinary, everyday movements of people to the skilled, choreographed movements of dancers.

A second workshop was held with two dancers, Esther and Gloria (pseudonyms). A fellow researcher also assisted with the workshop. The preparation, conduct and results of the workshop are described next.

7.2.1 The Divine and Bodily Experience

The finding from the first workshop demanded the need for a specific and well-defined context or domain within which to generate meaningful movements. To this end the design of the interactive space was structured and constrained in the following ways. The default physical and technical configuration for the space was a four-screen projection system and an overhead video camera for sensing the activity in the space. A series of four acts was conceived

that would address different kinds of movement, different combinations of audience and performers and different models of interaction between people and the system. Two of the four acts are described in Figure 7.12. Act 2 was assigned to Gloria and Act 3 to Esther.

A theme was chosen for the work of *The Divine and Bodily Experience*. It was selected for being an abundant resource of bodily and movement experiences engendered by existing religious and cultural practices, considered to be culturally shared and familiar to people. The meanings and motivations for bodily actions, movements and postures could be informed by such practices. It also provided a richer, recognised context for acts of falling. It was hoped that this theme would provide sufficient inspiration for choreography of movement and imaginings of what the interactive, immersive space might look, sound and feel like. In a choreographic sense, there was room for artistic interpretation of the theme, rather than a stereotypical representation or reproduction of ritual movements. The point here is that the particular theme chosen is not significant in itself, but for its ability to generate meaningful movements and for its accessibility to performers.

An *inspirational resource kit* was given to the two dancers in advance of the workshop to assist with briefing, delineating and inspiring the choreographic work they were to bring to the workshop. The kit provided a set of thematic constraints and various resources for inspiring and documenting the choreographic work. However, they were free to interpret the thematic content and bring in their own interests and training. The specific religious practice of Buddhism was chosen as the thematic content for the kit, as much for the ready availability of images and texts, as for well-established traditions of cultivating transcendence through the body. The kit contained image tiles, evocative texts, movement description cards, floor plan of space (A3 size), CD of music/sound samples and written descriptions of the acts and scenarios. A photograph of the contents of the kit is given in Figure 7.13.

A set of initial scenarios was provided to seed the design work and to give some indication of the possible behaviour of the system in response to the activity of people in the space (a selection is presented in Figure 7.14).

Act 2. Ritualising the Space In this act there will be a mix of performers and audience in the space. The performers will be performing more choreographed, exaggerated movements than the audience and will be invoking a ritualistic atmosphere. The system will respond to certain configurations or trajectories of performers and to specific movements or gestures, by changing the visual and sound output in some way. The thematic content is concerned with rites and bodily forms of worship that occur inside temples.

Act 3. Swooning in Ecstasy This act is a continuation of Act 2, but now more heightened and dramatic acts of falling are introduced that symbolise succumbing to or uniting with the divine forces. As with Act 2, the system will respond to certain configurations or trajectories of performers and to specific movements or gestures, by changing the visual, sound and lighting output in some way. The thematic content is concerned with heightened, transformative states.

Figure 7.12 Description of acts 2 and 3

Figure 7.13 Contents of inspirational resource kit

Scenario 2. Four performers enter the space. They move slowly amongst the audience, repeatedly performing a Qi-Gong like movement. Sounds of chanting emanate from the space. The projected images are now from inside a temple.

Scenario 3. Two of the performers begin to whirl on the spot. This triggers an operatic voice. The other two performers are invoking the divine from above. Then they swoon and spiral to the floor, or slowly collapse, and remain there. This triggers a change in the projected images. They slowly rise again, using an image of being pulled up by a string from the crown of the head.

Figure 7.14 Scenario fragments—initial

These fragmentary scenarios would be reworked into a coherent account of the activity of the performers, audience and system after the workshop to reflect the ideas and decisions made during the workshop.

This use of scenarios continues and extends earlier research, conducted in Project II, into the production and use of *movement-oriented* scenarios for exploring the interactivity of interactive, immersive spaces based on motion-sensing technologies. These movement-oriented scenarios focus on the activity and movement of people (typically users as audience) in the space, described in terms appropriate to the kind of space under design. Here the focus shifts from audience to performers. This enabled the examination of more complex and choreographed kinds of movement, compared to the everyday.

In the workshop, the dancers presented and explained how they used the kit. Each dancer then demonstrated and led the other workshop participants in performing the choreographed movements. The workshop concluded with the group discussing and documenting possible interactive treatments of the choreographed movements. The activities of the workshop were filmed for later analysis.

The analysis of the data generated from the workshop and the results of the study are now described in two sections that reflect the core activities of

(1) *generating* and *devising* movement and (2) *documenting* choreographed movement, accompanied by machine interpretations of the movement.

7.2.2 Generating and devising movement

This section describes the analysis of the activity of generating and devising movement. The development of each dancer's movement ideas and choreography is described, including their use of the resource kit for inspiration and documentation. Their different ways of choreographing movement were carefully examined to identify methods for generating and devising movement that could be useful for technology designers.

Using the kit

Esther worked with most of the resources from the kit—the evocative texts, the image tiles, the movement description cards, but not the music (she preferred to add music later, as she felt that music can dictate the choreography too strongly). She began by selecting a few lines of text that triggered a movement idea. She documented her movement choreography ideas on the large sheet of cardboard by using the image tiles and textual descriptions to build a thread or sequence. Interestingly, she placed all of it around the outside of the square representing the physical space of the system and did not use this space. A photograph of her use of the kit is in Figure 7.15. Here are selected quotations describing her way of working with the kit,

> It was selecting one of those (evocative texts) that I felt—something that gave me a movement impulse. Even the word 'suspense' ... I started to think about suspension, and that was something from the last session that I was working with, that sense of teetering and suspension. We live in a constant state of suspense and ambiguity. So from suspense, I thought of acts of suspension and trying to relate that to my act, which is *Swooning in Ecstasy.* I started to think about how something would build into some kind of swooning, or ecstatic state. I then started to look at the tiles, and I guess the images—I didn't choose them aesthetically, it was more about whether I had some kind

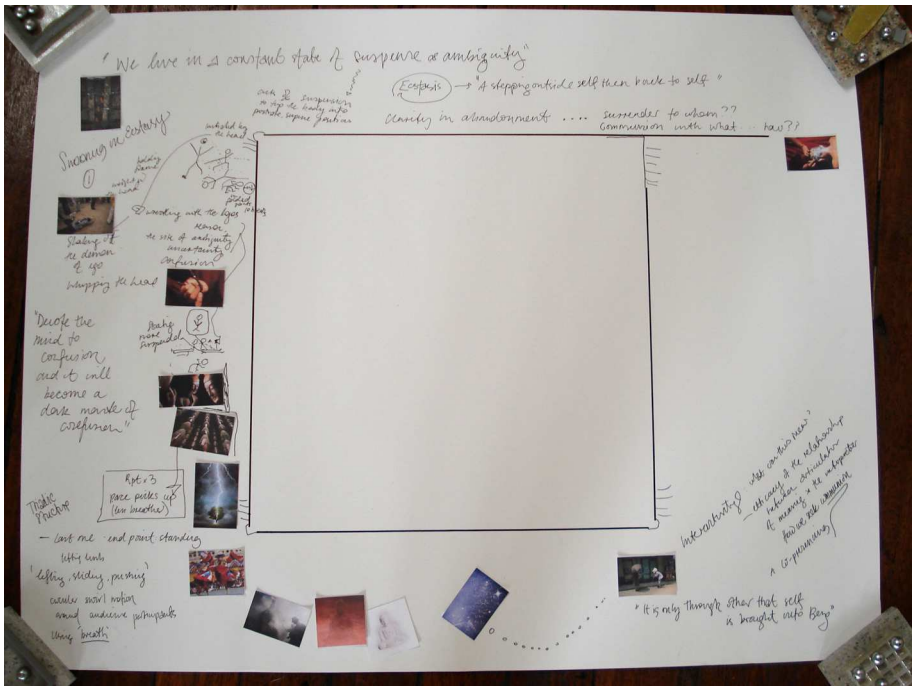

Figure 7.15 Esther's use of the kit for documenting her choreographic and movement ideas

> of feeling state from them. This was the first one I chose, which was quite interesting. These two. And in a way I feel a kind of generative narrative—not a narrative, but something that may relate to how the movement unfolds.
>
> I started to think about what swooning meant for me, in a way. I came up with this 'clarity in abandonment'—how that can also be translated in a movement sense. But then I started to move into things like, the Heideggerian idea of 'ecstasis', which is the Greek, stepping outside yourself, and back to self. It's his idea of temporality. And so that gave me a movement, kinaesthetic sensation about this stepping out, stepping in. But also the clarity in abandonment, so having a movement form that still has a form, still quite grounded, but the sense of surrender and abandonment that happens in swooning. Especially in the choreographic sense, I didn't want it to be a mess of—

Looking at her documentation, we can see that it is organised around the images and concepts. The focus is on the body movement arising from these

images and concepts. A series of stick figures depicts the sequence of movements in a choreographic phrase, noting the temporal development in terms of pace and repetition.

Gloria did not use the kit after the initial inspection of the contents. Instead she chose to develop her movement/choreographic ideas from the movement practice of Qi Gong (also spelt chi kung). She made brief notes in a small book. At the beginning of the session she transferred these ideas onto the large sheet of cardboard and found some image tiles that resonated with her ideas. A photograph of her use of the kit is given in Figure 7.16.

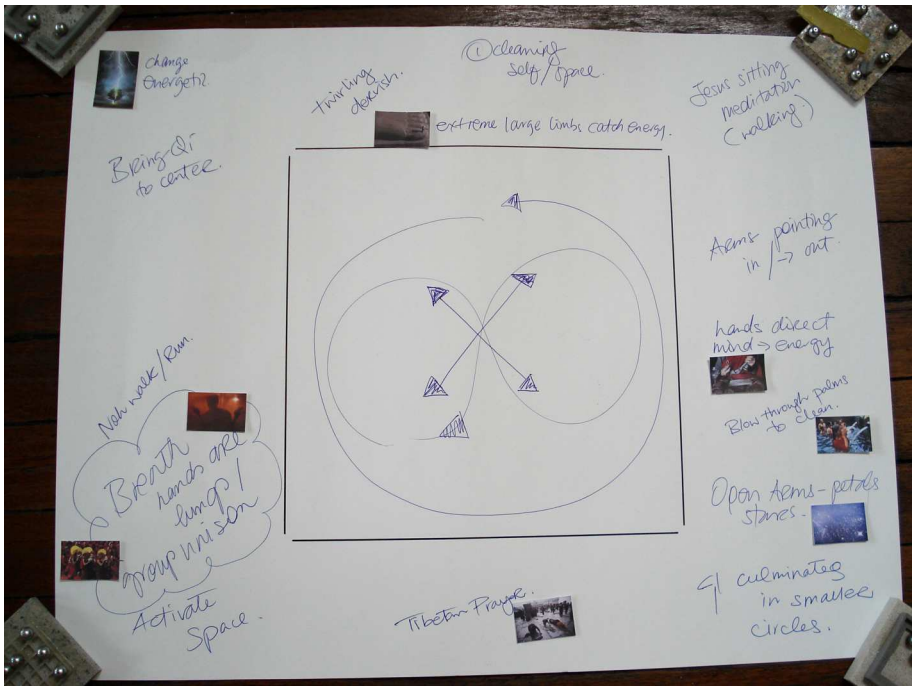

Figure 7.16 Gloria's use of the kit for documenting her choreographic and movement ideas

Here is a selected quotation describing her way of working with the kit,

> Well that was sort of interesting. I did it the way I usually do things. Having seen this initially and liked it, not knowing how I was going to use it, and did it my usual way. And then, it actually fits. It's good, all these pictures which I wasn't actually thinking about when I constructed it, well actually that one fits that, and that one fits that.

> So it sort of worked in retrospect.

In response to a question of what was her normal process,

> Just to do things. Feel it, do it and then scribble it out in a notebook. But more to actually feel what it means, as opposed to write it down. But then this (the images in the kit) actually made it quite easy to understand.

Looking at Gloria's documentation using the kit in Figure 7.16, we can see the ideas she had for structuring space and generating movement. There are strong spatial shapes and directions for moving in trajectories through space, for example, circle, figure-eight and radiating out from centre to corners. The body/movement ideas are predominantly expressed as a combination of gestures, energy (chi) flow and imagery. The image of a woman bathing with her hands held up to her face in a prayer position is annotated with the text "blow through palms to clean". The image of a star-studded sky is annotated with the text of "open arms—petals, stars". These two examples indicate the type of gesture and imagery to be used in performing these movements. As yet there is no specific sequencing or development of these movement ideas into a definitive choreography.

The dancers' quite different ways of working with the kit brought out the multiple functions of an artefact in design—in this case, the set of image tiles played a dual role: an *inspirational* role in terms of provoking and generating ideas and a *documentary* role in terms of providing an alternative form of articulating or presenting an idea. The movement/choreographic ideas are expressed or articulated through a combination of text, sketching and images. This documentation using the kit can then act as a resource for returning to the original ideas as conceived by the dancers.

Methods for generating and devising movement

A closer examination of Esther's process of using the kit reveals a method of generating and devising movement that begins from multiple entry points: a piece of text or a word can invoke a movement impulse or inspire thinking

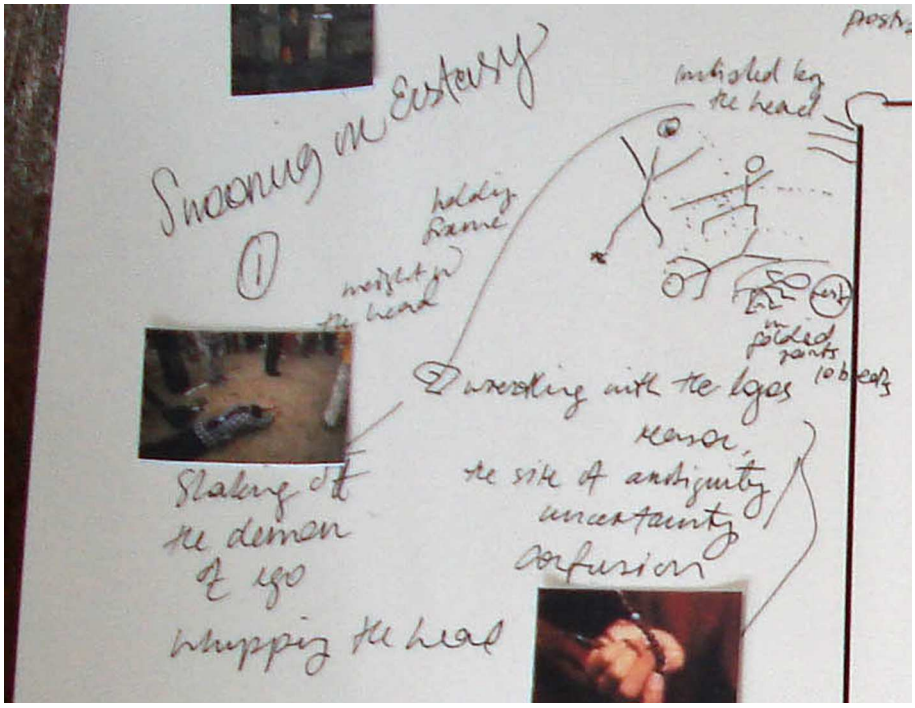

Figure 7.17 Close-up of Esther's use of the kit

on related or associated concepts; images can evoke a feeling state. A concept can give rise to a movement or kinaesthetic sensation that can then be developed choreographically.

A specific example illustrated in Figure 7.17 begins with an image of a woman lying prostrate on the ground. The annotated text by Esther reads "slaking of the demon of ego, whipping the head". The next reference to the head is "wrestling with the logos", which then leads to the stick figures depicting a sequence of positions, where the movement transitions are initiated with the head. In this example, there is a clear connection between the original image, the concepts and the movement choreography.

An examination of Gloria's process of choreographing movement (from observations and video footage) reveals another method for devising movement. She begins with a movement phrase taken from a traditional movement form. She then experiments with variations of the movement phrase through actual movement improvisation. She uses imagery and energy qualities to inform the character and shape of the movement. She uses her intuitive sense

of feeling things in the body to decide what works for this choreography. For example, with the "blow through palms to clean" gesture, she begins by breathing into the hands in prayer position, 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. The point of crystallisation of the choreography is not explicitly explained by her other than as a confirmation felt in-the-body through the integrated acts of sensing, feeling and moving.

Gloria's method of devising movement highlights a crucial aspect of working with the moving body, which is to have an understanding of movement 'in-the-body'. Movement possibilities are experienced and developed through the sensing, feeling and moving body. Rather than simply observing the movements of another, the imperative here is for designers to explore and perform the movement ideas, so that they can acquire an understanding of movement that is rooted in their own felt, bodily knowing.

7.2.3 Documenting movement

This section describes ways of documenting choreographed movement and the accompanying machine interpretations of that movement. Descriptions and representations of the movement choreography and interactive treatment were produced both during and after the workshop. A sample of these descriptions and representations is presented here to illustrate the range of textual descriptions and visual diagrams that can be used to capture the salient aspects of the moving body, for use in the design of movement-based interaction. Each of these descriptions and representations is discussed in terms of the role they can play in the design of movement-based interaction.

Directions for choreographed movement

These are descriptions of the inspiration and direction for choreographed movement, resulting from the workshop. This set of written descriptions of the choreographed movement for the performers was refined into a more

coherent account from the original wordings and ideas contributed by the dancers. The refined version was reviewed by the dancers to ensure that it was faithful to their original work and nothing had been omitted or misinterpreted. These descriptions are a written record of the choreographed movement, that details the specifics of how the body moves, the motivation for the movement and the kind of act in which the movement is contained. They provide directions for performing the movement. They overlap in part with the scenarios. An example from Act 3 is presented in Figure 7.18.

Act 3 - Swooning in Ecstasy, Section 2

The four performers begin to weave around the space, performing a *lifting limb* motif with both arms. One arm lifts the crook of the elbow of the other arm, then slides along the arm and then pushes the limb away in some direction. At certain points in the space, a performer may drop from standing to the *sitting buddha* position in front of an audience member. Or a performer may slowly crumble to the ground from standing. They slowly rise again, using the image of being pulled up by a string at the crown of the head.

The lifting limb motif of lifting, sliding, pushing works in a triadic structure. It is something that builds in pace over three repetitions.

"It's a lift, slide, push to work into a swooning. That way you can start working around people (audience members). It's probably a bit more chaotic: staggering, fleeting energies. It is possible for the performer to work three levels with the `lift, slide, push' phrase, once developed."

The final phase becomes a sitting in front of people - like the buddha. It is a weighted drop from standing into a squatting position. An aura of stillness is maintained until the position is shifted.

Figure 7.18 Directions for choreographed movement

Movement sequences

The movement sequences are a visual representation of the key movement phrases and postures of the body in the form of a series of images. They serve as visual reminders of what the movement looks like: the organisation of the

Figure 7.19 Movement sequence of Act 3, Section 1, with Laban Shape analysis

body and its parts, the shape of the body and the relationship of the body to its environment. They correspond to the directions for choreographed movement of the performers. They were extracted from the video footage and photo documentation taken in the design session. An example of a movement sequence with Laban Shape analysis is given in Figure 7.19. It corresponds to the original choreographic ideas documented in Figure 7.17. The performer is sequencing through a series of four postures. The transitions between the postures are initiated by the head. The last transition is rolling back up to a standing position. Only the postures are shown in the movement sequence here. The Shape analysis is explained in the next section.

The movement sequences may be useful for informing the design of the interactivity in terms of what the system can see or detect and its subsequent response, as required in the design of the input-processing-output loop, the traditional task of HCI. Comparison of the movement sequences over time can assist in determining the points of transition or differentiation, which in turn can be used for triggering specific system responses. It should be noted that the video footage of the choreography was taken from a side-on view rather than an overhead view due to the lack of technical infrastructure to support the mounting of an overhead video camera. This substitution does not detract from the process advocated here for exploring the mapping from an experiential movement perspective to a machine perspective. For any concrete design situation, the appropriate views would be acquired.

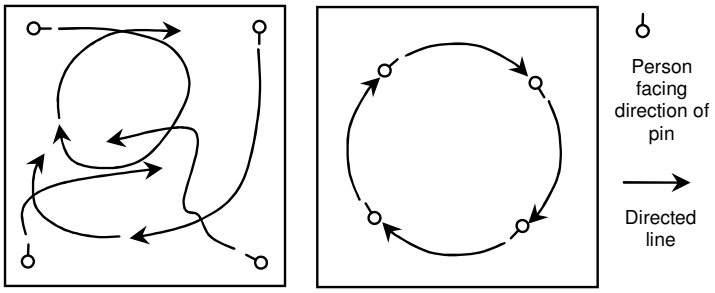

Figure 7.20 Spatial movement schemas for Act 2, Section 1

Shape analysis

The Shape analysis is a description of the changing forms and spatial qualities of the moving body. The Laban system of movement analysis was used to analyse and describe the spatial shaping of the body in relation to itself and to its environment (Lamb and Watson, 1979). See Chapter 3, section 3.4 for more details on the Laban system. An example of Shape analysis for a movement sequence is given in Figure 7.19. The Shape Form for the key postures varies from ball-like for the first posture to wall-like for the second posture where the performer is in a splayed position on the ground, then back to ball-like as the performer contracts back to a crouching position. The Shape Quality is sinking and enclosing for the first transition from standing to the crouched posture with leg extended in front. It becomes spreading and advancing as the performer dives into the splayed position belly-down. It then becomes enclosing as the performer gathers her limbs in towards her centre and pushes off into a crouch.

Spatial movement schemas

The spatial movement schemas are based on Labanotation floor plans (Hutchinson, 1977). They provide an at-a-glance view of the changing configurations and spatial trajectories of people present and moving in the space. They focus predominantly on the activity of the performers. Audience can be added to the schemas or mapped out on a separate overlay. An example of a pair of spatial movement schemas for act 2, section 1 is given in Figure 7.20. The

diagram on the left shows the trajectories of four performers entering from the four corners of the space and weaving around the space. The diagram on the right shows the four performers moving along a circular path in a clockwise direction.

Machine input schemas

Machine input schemas illustrate the choice of machine inputs, detection and interpretation of the input and the corresponding system response. For example, for the first section of the second act, *Ritualising the Space*, it was decided during the workshop that the incoming video data would be processed to detect the speed and shape of the trajectory of the performers. In response, the system would produce a wall of sound that intensified with increasing speed. Over time, the trace pattern of motion that emerges is circular in shape. This is just one possible interpretation of the performers' movements that focuses on the speed and shape of the trajectory produced by their locomotion through the space. The 'Collecting Qi' gesture was also nominated for detection, as the spatial shaping of the body was considered to be easily differentiable from the rest of the movements. The nomenclature for the Shape analysis descriptions could be referenced here, to provide a language for mapping between the experiential movement perspective and the machine perspective. The gesture itself could also be loaded with symbolic meanings, which could be expressed through visual or aural forms of system output. An example of a machine input schema diagram for Act 2, Section 1 is presented in Figure 7.21.

7.2.4 Findings

Preliminary work on generating and choreographing movement as part of the second study resulted in a key finding which was critical to the success of the study. With regard to the framing of the activity of generating and devising movement, the need for a *specific and well-defined context or domain* within which to generate meaningful movements was highlighted. This reinforced an earlier finding from the first project, where the context of the Eyetoy games

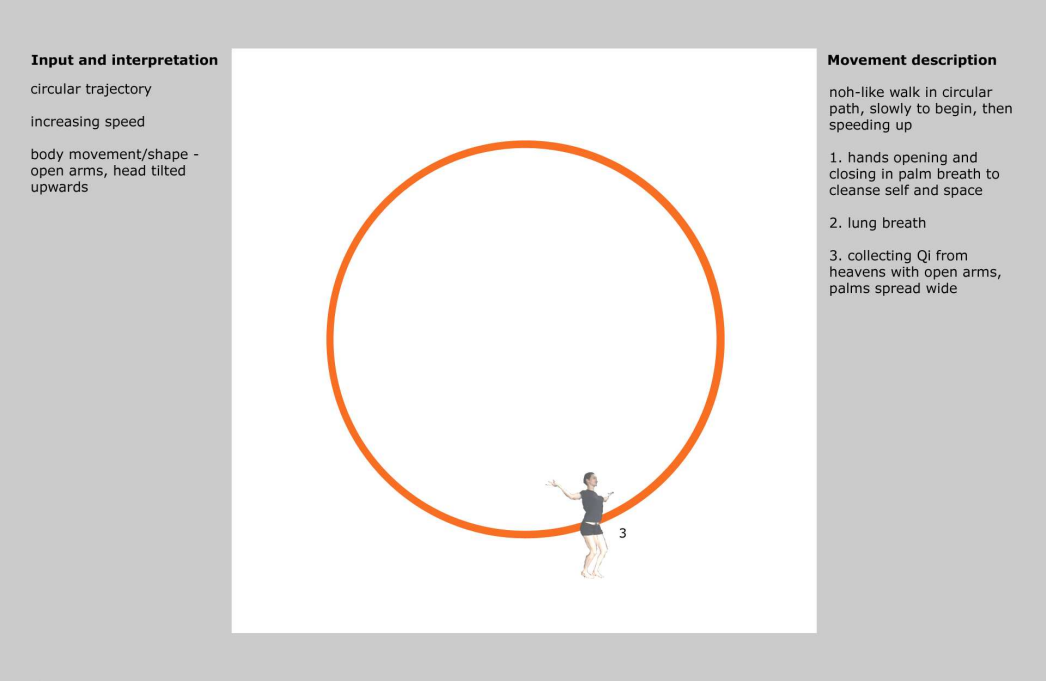

Figure 7.21 Machine input schema for Act 2, Section 1

enabled people to perform meaningful movements.

The continued application of Laban's system of movement analysis and notation in this project confirmed the usefulness of the system for describing and visually representing relevant aspects of movement to be treated as input to motion-sensing technologies, in particular Labanotation floor plans and Effort-Shape analysis.

The results from the second study contributed to a set of methods and tools for working with the moving body. These included methods for generating and choreographing movement and tools for describing and representing movement. The methods for generating and choreographing movement included scoring techniques from movement improvisation practices, working from image and text and working with kinetic variations of speed, scale and direction and qualities of movement. The tools for describing and representing movement included textual descriptions of movement motivation and choreography, visual representations of the choreographed movements in Labanotation floor plans, sequences of motion stills, Laban Effort-Shape

analysis, spatial movement schemas and machine input schemas. The results of this second study were then examined for potential expansion or refinement of the design methodology of Moving and Making Strange, described in Chapter 9 and published in Loke and Robertson (2008a).

7.3 Findings

The primary aim of the project was to validate and extend the findings from the first two projects. This was achieved in the following ways. Firstly, the Laban movement analysis and notation system was trialled in both studies. In the first study, the Effort-Shape analysis was applied to individual bodies in the act of falling. The Effort analysis had previously been applied in the Eyetoy project, where individual body movements were predominantly gestures of the arms. The act of falling provided a more complex, total body range of movement for analysis. The spatial shaping of the body became more significant and offered adequate data for Shape analysis. In the second study, Shape analysis was applied to individual bodies and Labanotation floor plans were used to describe the paths of movement and spatial configurations of multiple bodies. The Labanotation floor plans had previously been used successfully in the Bystander project. The Effort-Shape analysis was repeatedly trialled as it can potentially act as a bridging representation between the movements of people and computerised motion recognition systems that detect the dynamic, qualitative aspects of movement.

Movement-oriented scenarios were used in Bystander to represent the activity and movements of multiple people. Here they were used to first seed the choreographic work with initial descriptions of performers moving in the space and then later to detail the choreographed performer activity.

Suchman's analytic framework was not used in this project, as the details of the machine behaviour were outside the scope of the project. The hypothetical system of the second study was used only to provide a context for the generation of choreographed movement and speculations about possible interactive treatments, so that suitable representations could be constructed.

The act of falling was chosen for its potential to bring new insights into

the use of movement in the design process. It operated as a device for making strange, by working with skilled movers as the ethnographic 'exotic'. The knowledge gained of their process and experience of falling resulted in a new appreciation of the diverse movement experiences available within a single action and suggested avenues for potential use of falling in motion-sensing, interactive works. The research methods utilised in the data collection and analysis could be a useful approach for designers wishing to investigate other movements, not just falling, for the purposes of making strange and creative design work grounded in experiences of movement.