Making Strange with the Falling Body in Interactive Technology Design

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Abstract. In this paper we present the beginnings of a methodology of *making strange*, that can support the design of movement-based interaction with video-based motion-sensing technologies. By *making strange*, we mean ways of unsettling habitual perceptions and conceptions of the moving body to arrive at fresh appreciations and perspectives that are anchored in the sensing, feeling, moving body. This approach is demonstrated through a discussion of a study of falling that was conducted with trained dancers and physical performers. Analysis was performed on the raw data from this study from two perspectives - an *experiential perspective* and an *external* or *machine perspective* - generating a range of different descriptions and representations of the moving body in the act of falling. The results of the study identified potential methods and tools for inclusion in the developing methodology of *making strange*.

1 Introduction

"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." (p.143, The Primacy of Movement, Sheets-Johnstone, 1999 [our emphasis])

This research is founded upon a commitment to designing movement-based interaction from an experience of movement. Movement-based interaction refers to interactions with computing technologies which are based on the moving body as the source of input. It is an emerging subfield within the field of interaction design (eg. [23], [14]). In this research we are working with the moving body in interactive spaces built on video-based motion-sensing technologies. This commitment signals a methodological shift in perspective for designers, such that one of their fundamental activities is cultivating a *bodily* awareness of the forms, processes and qualities of movement being considered for design. 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. In the manner of von Helmholtz, we become 'laboratories unto ourselves' ([28]).

A starting point for this kind of inquiry into the moving body can be taken from the notion of "making the familiar strange", as described by the phenomenologist, Sheets-Johnstone, in the quote above ([28]). 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 ([28]) 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 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 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 perspectives 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. Edward de Bono ([11]) 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. This is not new and is an established principle in arts and design practices. For example, turning a picture upside-down interrupts our habitual patterns of perception and allows us to see the composition from a new perspective ([13]). Alternatively, we could turn our body upside-down to gain a similar, yet different, change in perspective! In a similar vein, Bell et al. ([2]) employ a method of making strange, or *defamiliarising*, understandings of the home in the design of domestic technologies. They use ethnographic techniques, in order to call into question our usual interpretations of everyday objects.

In this paper we present the beginnings of a methodology, for designers of movement-based interaction, that embraces this principle of making strange. It is a methodology that seeks to design *for* and *from* the sensing, feeling, moving body. To this end, it is characterized by two fundamental needs. 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 that enable design work to be done.

Other researchers have developed a variety of different approaches to designing for and from the moving body. There is a growing commitment amongst these researchers to grounding understandings of their design domain in their own experiences as sensing, feeling and moving beings through approaches including: the use of acting out and physical gestures by designers to analyse and convey findings, and to gain a bodily understanding of such gestures and interactions ([5], [6], [7]); the use of the moving body as both design material and the means of communicating design ideas

([16], [17], [12]); and employing experiential understandings of movement and kinesthesia as concepts and criteria for design ([22], [26]).

Representations of the moving body are a crucial part of the design process. Forms of visual representation include sketches, photographic images, video footage and stills, and movement notation, to name a few ([18], [8], [15], [24], [25]). Each form of representation focuses on certain aspects of movement, whilst throwing others into relief. As Bodker ([4]) recognised, representations are situated within the specific practices of design, and thus each design project uses and produces whatever representations are most appropriate. Her notion that representations cross boundaries between design and use activities is fundamental to the production of representations in this research.

The research work presented in this paper is part of a larger project aimed at investigating ways of experiencing, describing and representing the moving body in the design of movement-based interaction. We chose to work with trained dancers and physical performers for their expertise in experiencing, creating and performing with the moving body. The practices of dance, movement and choreography were seen 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, which start from the experience of the moving body. The first study in this series, the focus of this paper, is a study of the falling body.

2 Study of the Falling Body

This study examined the act of falling as a specific form of movement that is outside of our everyday realm of movement and has a complex changing form through space and time. 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. 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. 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 reaching and pointing, which are well known and researched in human-computer interaction and virtual reality.

The aim of the study was to explore the act of falling from a first-person, experiential perspective and from an external, observational perspective. 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. Interviews and physical demonstrations were conducted with trained dancers and physical performers to examine the process and 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 Effort/Shape descriptions of the qualitative, dynamic character of the movement. The data, results of the analysis and the activities of the study itself were examined to identify potential methods and tools for inclusion in the proposed methodology. These activities are described in more detail below.

2.1 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 interview/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. They 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.

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 first author 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]

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.

[First author rolls back] Look at your left knee. Yep, that's it. Good. Try it again.

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.

2.2 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 ([19]) in the use of video data for interaction analysis. The data then was 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, which we will call 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. Table 1 contains a sample of excerpts from verbatim transcripts.

Table 1. First-person experiential accounts 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 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 …"

The first-person experiential accounts and the video summaries fed into the next activity of analysing the salient aspects of the act 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. Each of these characteristic components will be elucidated with examples from the participants.

- 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

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 are 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 is 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 she is moving in. 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. We include the senses of the visual, aural, tactile, and proprioceptive/kinaesthetic (taste and smell are not included as they were not mentioned by any of the participants in this study). In regards to falling, it was interesting to tease out the relationship between the visual and kinaesthetic senses, and 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 Table 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 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 ([28]).

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*.

> "… it *feels very free* … it feels like my body, *I'm letting go, I'm releasing*, I'm letting go of my body … 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]." [our emphasis]

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."

Table 2 presents the range of participant descriptions of falling, sifted and organised into the three characteristic components of movement. It provides 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.

Table 2. Characteristic components for describing the act of falling, from an experiential perspective

| Characteristic component of movement	Participant description
Movement process /technique *Initiating the fall*	Finding pathways into the floor P4 Momentum of dropping down P1 Release from the centre P2 Like being pushed. An outside force. P5 Going off-centre P8 Finding interesting configurations P8 Toppling like a rock P1 Image of extension and then release – like a string being cut P6/ P7
Movement process /technique *Controlling the fall*	Internal muscular lift to slow down P4 Working in opposite direction to the fall P2 You could even control that more by taking your weight to the opposite side P1 Finding a way to support yourself down, with your hand P8 Collapsing by degrees P8 The cut gives that real weight to the body. Then it's a crumpling P7
Movement process /technique *Contacting the ground*	Bodily technique is release on the floor P3 Relax and soften P2 Making the contact with the ground take the greatest amount of time and cover the greatest surface area P2 Different surfaces give different sensibilities P6 Absorbing it in the joints P3 Distal initiation P3 Rolling down the body P8 Body is like a bag of bones P7
Sensing and awareness – internal and external	Always mapping where I am P4 Aware of your body within a larger space P7 Visual preoccupation can interfere with kinaesthetic sensing P4 Awareness of others, their rhythms P6 Visual sensing keeps me aware of the outside, otherwise can become too internal P6 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 P8
Felt quality	Paradox of light and heavy P3 Suspension and precariousness, teetering over the edge - dissolving into that P3 Out of surrender P5 A sensation of falling, but you're in complete control P1 Sense of suspension P6 Sense of weight, like a sack of potatoes P6 Feels exhilarating, then clunky P2

2.3 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. We present a rudimentary baseline of representations of the falling body 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. The movement sequences for participant 1 and participant 4 are shown in Figure 1 and Figure 2, respectively. The time between each image (snapshot) in the sequence is 0.4 seconds.
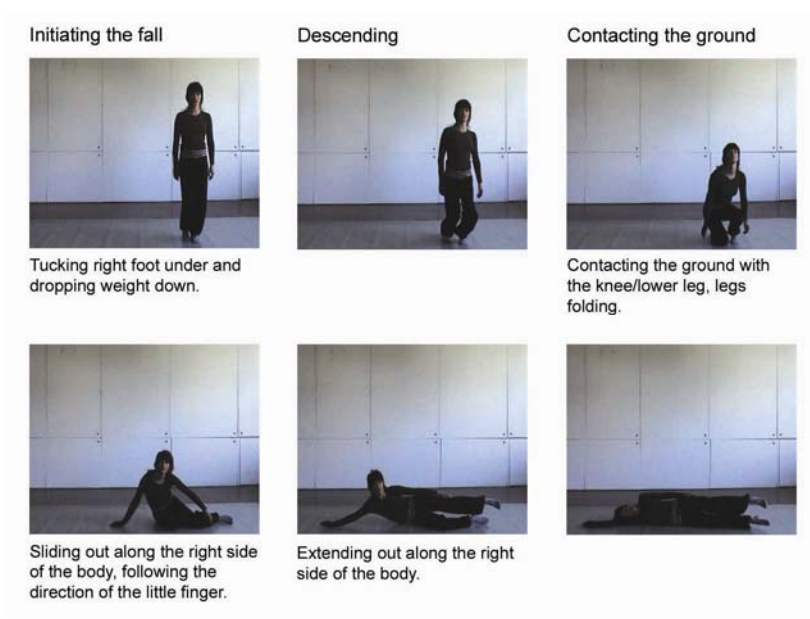
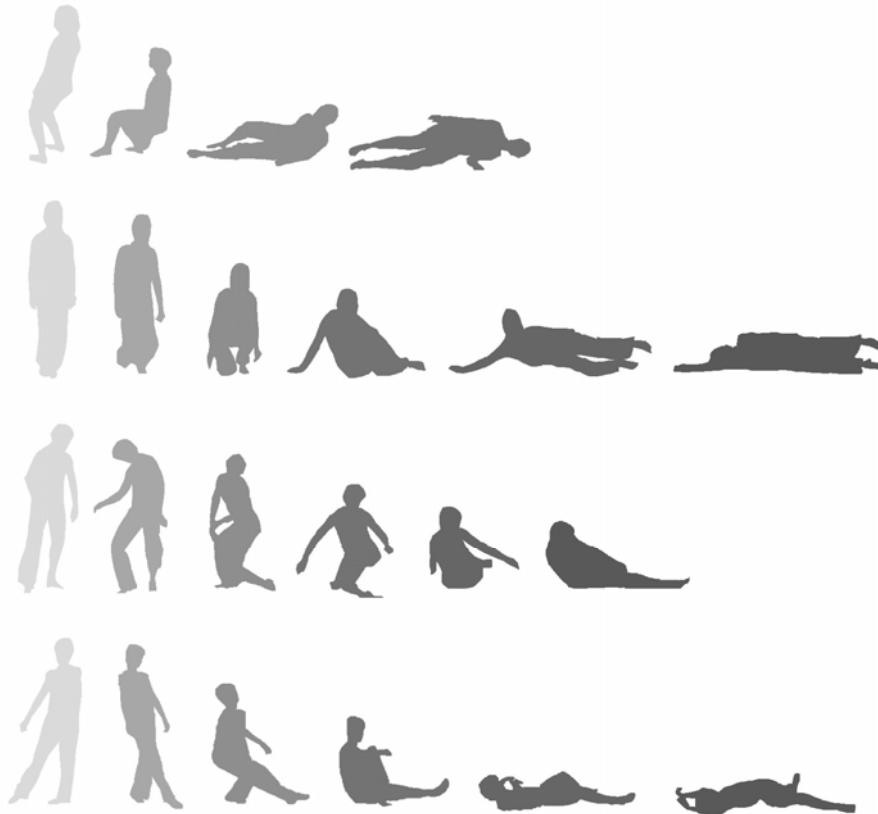**Fig. 1.** Movement sequence for participant 1
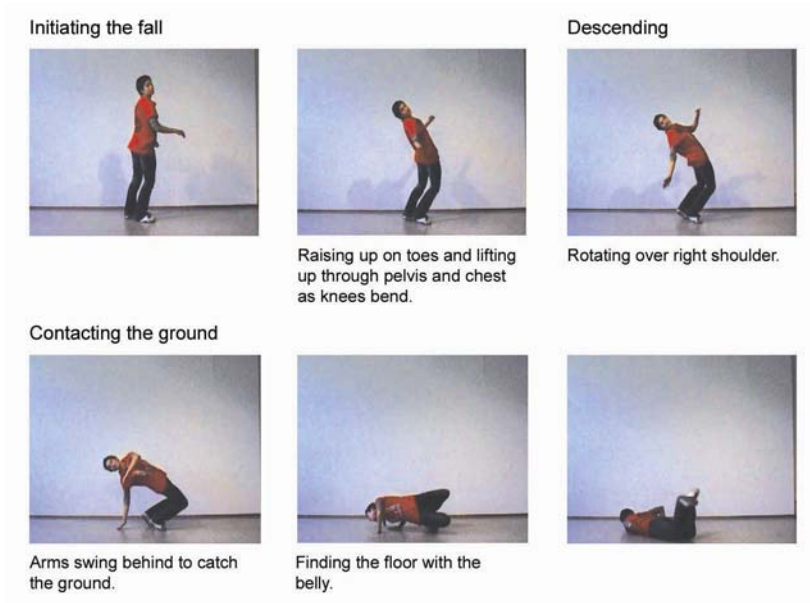
Fig. 2. Movement sequence for participant 4

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

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

Fig. 3. Silhouettes of the falling body

Figure 4 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.

Fig. 4. Mapping of head, centre of torso and feet over time for participant 4

Figure 5 illustrates the dynamically changing pattern of spatial shaping for participant 4, where each snapshot in the sequence is overlaid on the previous. The shade of grey deepens over time to indicate the progression of the movement.

Fig. 5. Changing spatial shaping for participant 4

The qualitative, dynamic character of the movement can be described using the Effort/Shape component of Laban's system of movement analysis or LMA for short ([20], [18], [1]). LMA is a system and language for observing, describing and analysing all forms of movement. It offers a vocabulary for describing the structural and physical characteristics of the moving body, the use of space, and the qualitative and expressive aspects of movement. Movement can be analysed in terms of *Effort* or *Shape*. Effort is the energy expended in performing the movement or the external expression of the inner attitude of the mover ([20], [27]). The analysis of Effort is given in four motion factors of Space, Time, Weight and Flow. An example of applying the Effort component to analysing movements used in interaction with a simple motion-sensing game application, Eyetoy, is given in earlier work ([24]).

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. *Shape* analysis provides a set of descriptors for dynamic, fluctuating shape characteristics, classified into categories of Shape Form and Shape Quality (other categories exist but have not been used in this research). Shape Form describes the static shapes that the body takes, for

example, wall-like, pin-like or ball-like. Shape Quality describes the way the body is changing toward some point in space, for example, opening or closing, indicating the degree of extension or contraction in the body. More specific terms include Rising and Sinking (along the vertical axis of the body), Spreading and Enclosing (along the horizontal axis), and Advancing and Retreating (along the sagittal axis). Shape analysis was developed primarily by Warren Lamb and Elizabeth M. Watson ([21]). They describe the shaping process as,

"The actual process of variation, which results in a succession of differently sculpted positions, can be described as a *sculpturing*, or *shaping process*. If we wish to become more aware of the shape of a person's posture pattern, as he dresses himself, or greets friends at a party, or elbows his way around a store, for example, it helps to imagine that all his joints are emitting vapour trails as though they contained jet engines."

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, and then spreading during the contact with the ground. See Figure 6 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 to enclosing, then to rising as the fall is resolved. See Figure 7 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. Two texts on Laban movement analysis provide a series of exercises to gain a bodily understanding of, and skill in using, the system of movement analysis - Laban's *The Mastery of Movement* ([20]) and Newlove's *Laban for Actors and Actors Dancers: Putting Laban's Movement Theory into Practice* ([27]).

Computerised motion recognition systems like EyesWeb exist that process the incoming video stream using algorithms based on Effort/Shape parameters ([9]). The EyesWeb expressive gesture processing library offers modules for motion, space and trajectory analysis ([10]). These kinds of systems are seeking to recognise the more expressive components of human movement. Our use of LMA and representations emphasising silhouettes and spatial shaping of the body fits well with this kind of system.
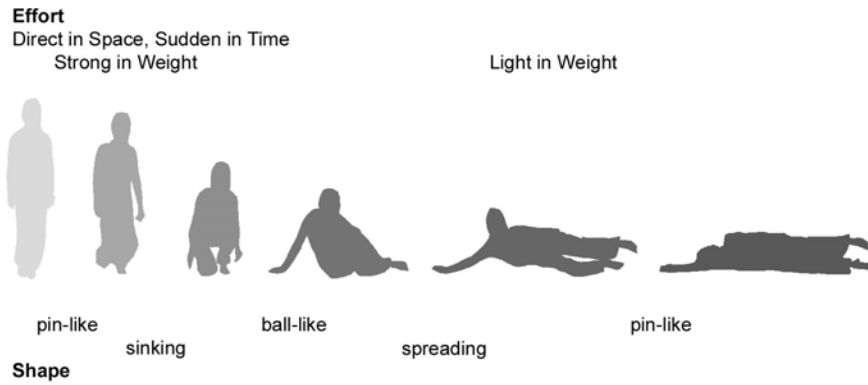
Effort
Direct in Space, Sudden in Time
Strong in Weight   Light in Weight

pin-like   ball-like   pin-like
     sinking   spreading
Shape

Fig. 6. Effort/Shape descriptions for participant 1

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

pin-like   arc-like   hinge-like
   sinking, retreating, spreading   enclosing, then rising
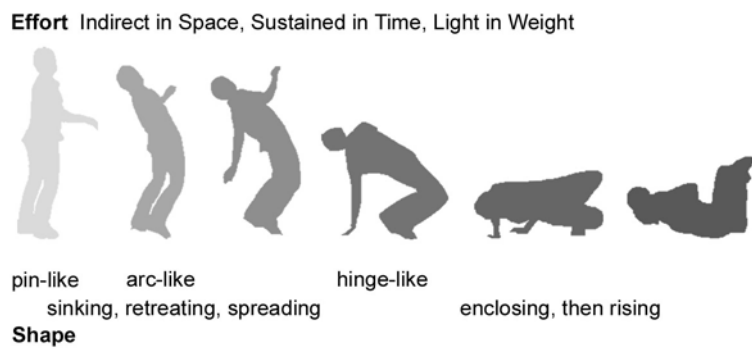**Shape**

Fig. 7. Effort/Shape descriptions for participant 4

3 The Beginnings of a Methodology of Making Strange

The activities of the study, the data and results of analysis were examined as sources of methods and tools for potential inclusion in the proposed methodology. The methods and tools were abstracted from this specific domain of falling, and reframed to be applicable, at least as a starting point, to any movement under investigation. The use of these methods and tools would be tailored and adapted according to the specific research or design context.

There are two main areas to the emerging methodology: *Accessing the experiential, moving body* and *Describing and representing movement*. Each of these areas contains methods and/or tools that may be useful for designers of movement-based interaction, who wish to base their work in the experiential, moving body and to produce suitable representations of the moving body which enable design work to be done.

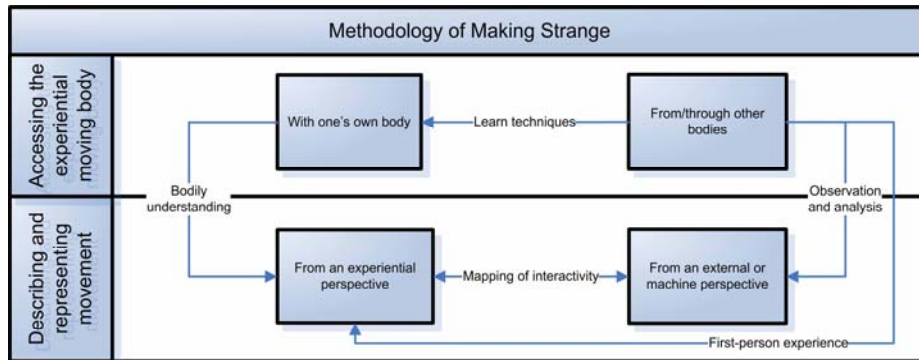Figure 8 presents an overview of the methodology, which is described in more detail in the following sections.

Fig. 8. Overview of methodology of *making strange*

3.1 Accessing the Experiential, Moving Body

The methods presented here are concerned with accessing the experiential, moving body, either directly with one's own body, or through observing and interrogating other bodies. This area of the methodology is directly concerned with practices of making strange through movement inquiry.

With One's Own Body. 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*.

Various techniques can be employed such as performing a movement with kinetic variations of speed, scale and direction to produce different dynamics and qualities of movement. The movement inquiry can be deepened through repetition of movements to consciously access in-the-moment sensations and process. 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. 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'. We can select physically challenging or unorthodox movements, like falling, for investigation. We can learn to perform a movement by breaking down a specific technique. The techniques presented here provide ways of exploring and improvising with the moving body to cultivate a refined awareness and ability of the sensing, feeling, moving body. They form but a small part of an established repertoire of movement improvisation techniques from dance and movement practices. Some of these techniques are published in the text, *The Moment of Movement: Dance Improvisation* ([3]). A bodily exploration and knowing supports the analysis of other moving bodies.

From/Through Other Bodies. The experiential, moving body can be accessed through observation, interrogation and analysis of *other* bodies.

Conducting movement inquiries with *skilled* movers provides finely nuanced understandings of particular kinds and forms of movement. One method of accessing their bodily knowledge is through *physical demonstration* in tandem with verbal explanation of their movement processes and felt sensations.

Recording this process on videotape provides raw data for feeding into the tools for describing and representing movement, described below.

3.2 Describing and Representing Movement

The tools presented here are for describing and representing movement. They fall into two categories: describing movement from an experiential perspective, and representing movement from an external or machine perspective. The first category of tools provides renderings of understanding and describing movement, based in actual experience of that movement, and couched in the language of the person explaining their own movement. The second category of tools provides a rudimentary baseline of visual representations of the moving body. These 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.

Describing Movement from an Experiential Perspective. These descriptions preserve the voice of the person describing their understanding of their process and experience of particular movements.

First-person experiential accounts are edited transcripts of a person explaining how they perform a particular movement, how it feels in the body, and how it fits into their practice. These accounts can be rendered into a more condensed form of description using three *characteristic components* of movement. The three characteristic components are Movement process and technique; Sensing and awareness – internal and external; and Felt quality, as explained in the analysis section of the study.

Representing Movement from an External or Machine Perspective. 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 interactivity, and bridge the interface between human-centred design approaches and technologically-driven implementations.

The *movement sequence* is presented in a number of formats to provide different kinds of information and emphasis. Movement sequences extracted from video data focus on the key postures and organisation of the body through its trajectory in space/time. 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. From these movement sequences, a

range of other data can be derived such as changing position of the body and its parts, the trajectory of the moving body, use of space, timing and rhythm.

Laban's [20] 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 relation of the body to itself and the environment. The qualitative, dynamic character of movement can also be described less formally using *evocative and metaphoric language* that conveys the essence of the movement [7].

4 Conclusion

We have presented here the beginnings of a methodology of *making strange*. This methodology marks a significant shift in design perspective that calls on designers to re-examine their assumptions about the moving body through practices of *making strange*; that is by unsettling or disrupting habitual perceptions and taken-for-granted conceptions of the moving body through a movement inquiry of our own bodies and the bodies of others.

The methodology of *making strange* offers methods and tools for experiencing, 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. In its current state it contains two primary areas: accessing the experiential, moving body and describing and representing movement from the experiential and machine perspectives. The methodology is by no means complete, but it offers a starting point that can be both expanded and refined through further research and investigation. The second study in the series of this research project investigates choreographic and movement improvisation techniques for ways of creating, devising and documenting movement that may be of use to designers of movement-based interaction. This is an aspect of designing movement-based interaction which we identified as missing from the current state of the methodology after a careful analysis of the findings of the study of falling that is reported here.

The assumption behind our research is that design of movement-based interaction begins with the experiential, moving body. In future movement-based interactive spaces, we will need different kinds of movements with meanings that are as yet, unthought. We suggest that the methodology of *making strange*, introduced here, can act as a way of orienting and supporting designers of movement-based interaction within emerging motion-sensing technologies.

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