Abstract
Designing interactive systems that have illusive interaction qualities, such as suppleness or pliability, is challenging. In several design projects aiming for bodily and emotional interaction, we have aimed to find concepts, methods or processes that can capture the essence of the sought experience and steer the design process in a successful and efficient direction. Our attempts include using e.g. Laban-analysis of emotionally-oriented movement, video-cards from ethnographic studies of users in movement, or simply explicitly naming and defining the sought interaction quality. Our experiences point to the importance of moving from low-fi prototyping to high-fi – no matter which artefact is used to keep the design team on track. Repeatedly exposing unfinished prototypes not only to prospective end-users, but also to the whole design team has been another important part of our process. Finally, a deeper, theoretical and design-oriented understanding of emotional and bodily interaction is badly needed.

Keywords
Emotion, body, movement, design process

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.
Introduction

During the last years, we have worked with several projects where bodily movement is at the core of the interaction [2][4][5][6][11][20][21][22][23], [24]. In particular, we have been striving to involve users in movements that can start experiential processes relating to emotion. Ever since the work by Darwin [1], it has been known that certain movements are closely related to emotional processes and vice-versa. Philosophers such as Sheets-Johnstone [18] and Shusterman [19], have shown the importance of movement as the basis of our whole way of being in the world. Choreographers and dancers, such as Laban [10], and theatre movements, such as method acting, have made similar points: by portraying emotions in movements, we can come to experiences that we would not have otherwise. Some even claim that emotional experiences are impossible without the corresponding physical state in terms of muscle tensions and body postures [18].

Based on the work of these philosophers, dancers, and choreographers, designers have attempted to build systems that capture similar experiences in interactive design [3][13][14][15][16][17]. Obviously, any such design will not determine the users’ experience, but it can evoke processes that users may decide to become involved with, creating their own experience in interaction with the system.

Hummels and colleagues have pointed out that it is important that designers “move to be moved” [3]. Their point of view is that designers can find new method for design through doing design by moving around. Our point of view is perhaps even more strongly suggesting that you can get emotionally moved by moving physically and that the only way to make sure that this works is if the design process involves repeatedly moving with the system to make sure that the sought experience is indeed addressed by the designed system.

In our experience, this design process is very difficult. We have seen how using the body and gestures in interaction tend to be far more vulnerable to slightest delay or mistake in interaction compared to more traditional interaction. It is only when the interactive system can be designed to work without creases or cracks in the interaction that it reaches the kind of experience sought. We have previously named this quality suppleness [7]. We see suppleness as an interaction that relies on subtle social signals, emergent dynamics and moment-to-moment experiences: “a supple system is doing sort of a social/emotional ‘dance’ with the end user.” [7].

Let us briefly touch upon some of our design process experiences to show how we have attempted to make our whole design team come together to achieve these kinds of qualities and the artefacts we have used in those design processes. We will discuss our insights when it comes to the importance of moving from low-fi prototyping to high-fi – no matter which artefact is used to keep the design team on track. Repeatedly exposing unfinished prototypes not only to prospective end-users, but also to the whole design team has been another important part of our process (similar to the work by Boehner and colleagues [17]). Finally, from our experiences, we have found that a deeper understanding of emotional and bodily interaction processes is badly needed in order to systematise and
move forward in this (increasingly important and growing) design field.

**Designing “eMoto”**

In one of our first design projects, we wanted users to express themselves by gestures when sending mobile text messages [23]. We altered the stylus pen that came with some mobile phones, adding sensors to it that could pick up on angry, happy, calm or sad gestures. These were then transformed into colours, shapes and animations in the background of users’ text messages; see Figure 1 and Figure 2.

In order to figure out which gestures could be relevant, we tried to stay focused on users’ experience of making certain movements. We used Laban-notation to write down the effort (inner experience) of the movements we wanted to portray, see Figure 3. We repeatedly tested our design against that description in an iterative design cycle. As it turned out, it was very difficult to get the interaction right: the timing between gesture and system reaction on the mobile was crucial, the congruence between gesture and animation on the screen had to be perfectly in harmony, and on top of that, it had to be relevant to our physical experiences of emotions, see Figure 4.

The only way to get it right, was to repeatedly test it, both with ourselves and with our users. Still, the design of the stylus pen did not, in the end, become optimal to the purpose. It is slightly too large, you have to squeeze it to start it, and some of the gestures do not feel perfectly as they should.

The artefact that kept this process together, was perhaps not the Laban-analysis only, but mainly our joint understanding of what ‘feel’ we wanted from the system – but we had no way of externalising that into any useful form.

**Designing “Affective Diary” and “Affective Health”**

While eMoto allowed users to explicitly express themselves through gesturing with the stylus (it did not automatically pick up on movement – you had to start it to make it work), our next projects concerned picking up on bio-signals, such as heart beat, sweat (through GSR) and movement (using accelerometers). Our aim was to design tools for self-reflection. Bodily data were portrayed either on the computer screen (Affective Diary, see Figure 5) or in real-time on your mobile (Affective Health, see Figure 7), together with other mobile media (text messages sent/received, Bluetooth encounters, etc.), [20][11][2][24].

In these projects, it has been even more difficult to find the artefacts that can keep the project steered towards a successful design. In a sense, the reason is the same as in the eMoto project. It was difficult to express the sought feeling that what was portrayed on the screen was in fact aspects of my embodied being in the world. The Affective Diary project started with a cultural probe specifically directed at our everyday experiences of our own bodies and emotional stories. It gave us a rich material to start from – a material that we came back to a number of times, see Figure 6. In the end, Affective Diary became a very successful system that made its users both reflect on patterns of behaviour in their life, and even attempt to learn from them and change their behaviour [20].
In the Affective Health project, we tried to formulate what we meant by feeling as ‘one’ with what the system portrayed in real-time. We used high-level descriptions such as ‘being one with the representation’, ‘feeling whole’, ‘non-dualism’, and ‘the representation should feel alive’. In this project, several new students came and left and the main designer left on maternity leave, which meant that we kept having difficulties in steering the project towards the kind of experience we were hoping to stage for. Similar to the eMoto-design process, one of the main issues was, and still is, the properties of the material we used to design the system: sensors worn on the body, Bluetooth communication from those to the mobile, and the limited space on the screen for portraying data and historic data in real-time [24]. The design process had to keep the two strands of material exploration and design goals on-going all the time, with a rich dialogue between them. We used Wizard of Oz-methods to enable such a dialogue even before the different parts of the system existed [2].

Designing “Lega”
Our latest design project is trying to move our experience of FriendSense guide the design of an artefact that we aim to be used in an art museum. The system is being patented, so we cannot reveal details of the actual system, but two aspects of the project are interesting as examples of artefacts used to keep a big design project focused.

First, we had to figure out how will friends express themselves when visiting a museum together? We performed an ethnographic study of their behaviour, videotaping their movements and gestures. From those videos, we created a set of cards (see Figure 11) that were used during the brainstorming sessions. The method is similar to video animations used by Löwgren, but more focused on bodily movement.
Another important process that kept the project tightly knit together has been to hold a 'techfest' once a week where all the participants in the project get together to build and test the current prototype(s). This has been extra important in a project that has had competencies ranging from industrial design, HCI-experts, SW engineers to hardware designers.

**Discussion**

Our experiences point to the importance of moving from low-fi prototyping to high-fi – no matter which artefact is used to keep the design team on track. We have also learnt that we need to cultivate deep knowledge of the high-fi-material (be it sensors, wireless communication, mobile screens, animations or sensorode programming) among all the participants in the project. Bodily and emotional interaction is extremely sensitive to the physical properties of the interaction – and everybody in the project needs to be highly aware of the possibilities and limitations of the material. Repeatedly doing build "tech-fests" with all participants in the project where everybody gets to test the latest versions of the prototype as well as "feel" the digital material has been a useful process to us.

A second insight is that we might not be able to verbalise or otherwise externalise the "feel" of the interaction we are aiming for – be it suppleness, embodied self-reflection or something else. Instead, we have to repeatedly expose ourselves (and other user – but most of all ourselves) to unfinished prototypes and seriously try to interact with it as it was going to be a part of our life. Sometimes this requires that the design team use a system for a week or more, daily, together. Sometimes you have to wear bio-sensors in your everyday life and imagine the feedback on the mobile even when you know that what you see is a fake animation.
Finally, a deeper understanding of emotional and bodily interaction processes based on non-interactive as well as interactive systems is badly needed. There are very few methods for design and evaluation that we have found relevant to our work. We have invented a couple of methods to help us on the way, such as the Sensual Evaluation Instrument [8], see Figure 12 and a method for in-situ informants [23]. We are currently investigating how we can study people's everyday activities from a movement and emotion perspective, including skateboarders, golfers and users of BodyBug [9], museum visitors, and horseback riders. While Laban-notation has been useful to us, it is a complicated way of describing movement and we need a method/tool/artefact that speaks more of interaction rather than individual movement. It is in the unfolding of the interaction over time, in its dynamic gestalt, that the 'feel' of the bodily and emotional experience will unfold.

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References
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