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How do you design for the joy of movement?

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The work in this book¹ was conducted at an exciting point in time when the whole field of Human-Computer Interaction shifted its focus away from settings in which people would sit more or less still in front of static computers, to instead start exploring how to make good use of all the added possibilities of technologies that can be moved around. At the same time, researchers became increasingly interested in aspects of experience and enjoyment in the use of technology. As discussed in the introduction, notions such as play and learning, work and leisure, casual and serious technology use, are sometimes presented as conceptual dichotomies that may be difficult to combine. However, to many people, such distinctions are not meaningful, since practices and technologies – especially mobile ones – travel between the different social spheres of our lives, accompanying them wherever they go. Therefore, addressing aspects of leisure, pleasure and play is a relevant challenge for most interaction designers. In many cases, mobility and enjoyment seems very tightly intertwined, and in this chapter I will discuss different ways that this has become manifested in the illustrated pages of this book.

The examples are sorted into five themes that each provides a perspective that can be addressed in design:

1. Sensing ones body: the enchanting joys of bellyaches
2. Toys: or things for your hands to fiddle with
3. Performance and spectatorship: there's no business like show business
4. What technology can sense: the magics and mysteries of digital feedback
5. Casual leisure: the luxury of having nothing to do

1. Sensing one's body: The enchanting joys of bellyaches

"It is an equally obscure point why the corners of the mouth are retracted and the upper lip raised during ordinary laughter. [...] The respiratory muscles, and even those of the limbs, are at the same time thrown into rapid vibratory movements. [...] During excessive laughter the whole body is often thrown backward and shakes, or is almost convulsed. The respiration is much disturbed; the head and face become gorged with blood, with the veins distended; and the orbicular muscles are spasmodically contracted in order to protect the eyes. Tears are freely shed." (Darwin 1872, p 206)

Reflecting on the above quote, it is obvious that our physical bodies can never be quite neglected in the ways we enjoy ourselves. From the thrills of being on a rollercoaster to the simple pleasures of cuddling with loved ones, having an ice cream, or laying down to relax on a sunny beach. Many of us actively seek

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out more ritualised forms of bodily action, in the forms of sports, yoga, dancing, fishing, cocking, etc. The recent success of movement-based game platforms such as Wii and Kinect, and the variety of new wearable equipment for sport settings, also shows that many people like to engage bodily also with digital media.

Proprioception and kinesthesia are two terms that researchers use to describe the personal experience of movement, e.g. how an arm is held in relation to one's torso, or how the whole body is moving through space. These sensations, along with the senses of balance, acceleration, touch, muscle force, and all the other senses, let us make sense of ourselves as we move about in the world. These kinds of experiences are obviously important for any living being, for navigating, for learning, and for playing. Despite all the new technology that is around, we are not surprised to see that children are still absorbed in ball games, swinging, climbing, hula hooping, making sand castles, or setting up theatre performances. In a study of the unsupervised play in public playgrounds (Jarkievich et al. 2008), tweens made extensive use of their phones as part of playing, but the playing was still highly physical in kind. Cameras and ringtones were used as parts of a hide and seek type of game, they recorded music videos and dance performances, but they did not seem so play much games individually on the phones.

So how can all this be further taken into account when designing new mobile experiences? Several design explorations in this book have aimed at solutions that encourage play through bodily movement, for instance *Weathergods* and *Fruitkids* (page 146), which is a collaborative game for exploring the concept of energy, where running and making use of muscle force became an important part of the game. *Traveur* (page 142) is another example, supporting Parkour runners in training and sharing videos of physical tricks. Other examples include the *Oriboo* (page 136), *moBoogie* (page 156), and several of the inspirational bits demonstrators (page 54). Further understandings of this design domain have been sought in a series of in-depth analyses of existing low-tech leisure practices of golf, horseback riding, joyrides at an amusement park, and skateboarding (e.g. Tholander & Johansson 2010). The researchers have also addressed bodily experiences beyond those of large movements that are visible to others, looking at experiences of more subtle actions. Such projects have put more emphasis on the internal experience of one's body, such as the sense of tension in a particular muscle group when learning to ride a horse (page 24), the sensation of interacting with frozen water (page 163), or the haptic feedback from a device you hold in your hand (page 132). The 'beauty' of such experiences is obviously something very different from visual beauty, and is sometimes referred to as 'somaesthetics' – the aesthetics of the living body (Shusterman 2011). Some of the research presented in this book is in the international forefront of bringing aspects of somaesthetics into the discourse of interaction design.

An important observation from the above mentioned studies is that designing for bodily activity not necessarily means that the technology has to be moving, as seen in the *Traveur* case where the tricks were usually performed while the device was fairly static and recording. It does not even need to be the user who controls the movement, as in the extreme case of the rollercoaster (page 32), or in *Backseat Playground* (Brunnberg et al. 2009), where the user is instead taken on a ride. An even more extreme example is the explorations of brain games (page 138), where the players are meant to be essentially static in their interaction, yet with attention set towards bodily experience and physical performance.

To summarise this theme, most people enjoy moving about, but the movement does not need to be extreme, big or complex to trigger interesting forms of engagement. Body movement does not have to be triggered by the device, or even sensed by it, to become an essential part of an interactive experience. Finally, an attention to bodily experiences is not only relevant when designing for children and for fun, you will never get around the physical nature of how activities are experienced within us as living and moving beings.

2. Toys: Things for your hands to fiddle with

Needless to say, engagement with interactive products is mostly based on manipulation using hands and fingers. It is often through fine motor actions that we master various physical buttons, touch screen surfaces, and other controls to communicate and to manipulate digital media. The physical outside of a mobile device even define much of how a system running on it can be used, and how different forms of media can be captured, edited, controlled and manipulated.

During the years of 2007-2012, when the research in this book was conducted, mobile phones went through a massive shift from predominantly very small screens with physical buttons below, to slightly larger touch-screen devices. This small change affected the whole interactive setting, shifting focus from discrete input types to possibilities to zoom, swipe, play and browse in a much more dynamic manner. In what is sometimes called 'pictures behind glass' manipulations, as in surfaces on tables or tablets, you zoom, browse and navigate among visual content by gently stroking your fingertips. Even completely 'touchless' interfaces, like in games consoles such as Xbox Kinect, where players do not need to touch anything at all. These modes of interaction are today extremely popular, especially for casual and playful settings, and they also trigger bodily actions in interesting ways. Thus, when we think about new interactive designs, it is natural to focus on the fluid and dynamic materials displayed on screens, and all the interesting things that can take place there. Screens are central to how most people envision the digital, and a common research focus in this domain has also been on interactive media as presented on small screens, e.g. for watching videos, playing games, and interacting socially online. Simply fitting all the relevant content onto very small screens naturally implies challenges for designers, especially when combined with completely new interaction modalities. However, this occupation with screens might have stolen some focus from the large space outside them, and the basic experience of being a person born with a very sophisticated set of fingers. Drawing on this, several projects have explored how digital things can be physically manipulated with one's hands, borrowing qualities ranging from children's casual playing with toys, to skilful manual practices, such as learning to draw or play on a new musical instrument.

A few years back some of us noticed how laptops were commonly made more personal by carrying them in customised cases, mascots and charms were attached to mobile phone handsets, and people were even making their own decorative covers for robotic vacuum cleaners. Similar to practices of playing with dolls, physical objects simply lend themselves to decoration and accessorising. In a series of design experiments called ActDresses (page 148), we explored scenarios based on physical clothing, labels, and accessories as a mode for interacting with and controlling various interactive gadgets, including robotic devices and mobile phones. Thus, by studying and taking inspiration from playful practices of

manipulation in the real world, new design concepts for interaction with technology can be developed. The physical form of objects even 'invite' us to touch, or act upon them in certain ways. The grip for a door handle often has very different material properties than one designed for e.g. a tennis racket, or a coffee cup. This may seem obvious, but is actually quite relevant to the development of new technical devices, perhaps most visibly in the domains of electronic toys and game consoles. A toy with a rubber or hard plastic casing may for instance be understood by a child as more waterproof than one covered in a soft fabric (and so they will take it for a bath). Simply placing technology in a certain material, or giving it a new physical shape or size, thereby affects what people will do with it. All this said, the physical manipulation in these settings cannot be fully understood without also understanding the dynamics of the digital media that these aim to control.

To sum up this theme, designing for screens alone may make you miss out on some qualities of traditional toys and games, of which the most obvious include the ability to touch, hold and in various ways manipulate with hands and fingers. Designing in this domain requires attention to the interplay of physical manipulations and digital materials, but also aspects beyond the digital. Thus, there is more to interaction than meets the eye!

3. What technology can sense: The magics and mysteries of digital feedback

Many of the common hardware platforms in recent days, such as smartphones, tablets and game consoles, contain an almost amazing set of sensors that in various ways may respond to the movements of people. These sensors may pick up e.g. radio signals and thereby estimate a person's location within a room indoors, or connect with satellites in the sky to track movement across larger outdoor spaces, or use inbuilt cameras, gyros, compass sensors or accelerometers to identify small gestures with the device in hand. For some of the examples presented in this book, movement and mobility have been explored partly to learn about the potential uses of these new hardware capabilities. The researchers have for instance conducted studies on properties of specific sensors (e.g. accelerometers), studies on how to design moving or kinetic artefacts (e.g. robotic toys), tools that encourage body movement (e.g. dance and music applications), and in-vehicle interactive systems (e.g. games for passengers in a car). Many of the projects have explored brand new technical solutions for capturing movement, thereby highlighting of the curious features of new tools and materials that none in a design team may have had a chance to explore before. One goal with our research is thereby to learn about new material properties, so that interaction designers in the future can use them to make more fully functional products. In the inspirational bits approach (page 54), Petra Sundström and colleagues conducted a series of small experiments that people could test out to better understand the properties of technical materials as Bluetooth, Wi-Fi, and accelerometers. Interestingly, in the hands of people, these experiments quickly turned into games for playing, where test persons collaborated and competed around shifting rules for participation and play.

Typical for technologies such as these is that it is sometimes hard to see what a device is actually sensing. You may not be aware that the device for instance records your physical location or tries to communicate with another unit. Even as designers, it is often difficult to make sense of and sketch with such invisible forms of data streams, which may be picked up by the technology that we use. A specific research question has therefore concerned not just the sensing, but ways in which these sensor readings can be

made interesting and meaningful to people in their engagement with the system. Examples on this theme include the OtherBrother (page 144), Affective health (page 155), and the Rudiments explorations (page 150). This work has led to new insights regarding the design features of different interactive materials, both how they can be handled by users, and how designers may make use of them, in forming meaningful the relationships between physical manipulation and digital media. One main outcome has been an increased understanding with regards to breakups and delays in movement-based interaction settings.

Given the low-tech character of traditional sports and other movement-based activities that have never needed any digital feedback, one may assume that the digital feedback is not so important in these settings. However, our studies have shown that the digital feedback is extremely central to the design of movement based systems, and that breakdowns such as battery failures or even a short delay, is a major cause of frustration in most such play settings. Thus, both digital feedback and bodily action will require energy, and you need to charge up them both before playing. Another issue has been the general challenge of translating physical action into digital media forms in meaningful ways. Through a concept called 'Affective Loops', the researchers have further discussed these aspects in the ways we express and interpret emotions, for instance via social media and using new and bodily forms of engagement.

When designing for movement-based interactive settings, a core challenge is to make use of technology in a way that provides expected and timely response to the actions performed by the users. Thus, as designers in this domain, it gets increasingly important to get to know the properties of different digital tools, sensors and materials.

4. Performance and spectatorship: There's no business like show business

A quite central feature of mobile devices, just like accessories and clothes, are that they are physical and thereby can be seen by others (even if they may stay hidden in pockets much of the time). This also means that their mere physical appearances may be used for getting attention, working as an indicator of the current state of an activity, or as a trigger for new conversations. Moreover, and as already mentioned, someone may have made a device more personal by placing stickers on it, its surface may have got shaped by wear and tear, and a particular person may perceive and interpret such signs in a variety of ways. According to a recent study on how mobile phones are treated in fashion blogs (page 94), it seems that the very surfaces of physical mobile handsets are in fact more prominent than software features in the social space, e.g. as indicators of one's own sense of taste or lifestyle.

In a project called eMoto (Sundström et al. 2005), the idea was to design a mobile service for sending and receiving emotionally expressive text messages on a mobile phone. The system added animated backgrounds to text messages by using expressive gestures with a special stylus pen, equipped with a pressure sensor and an accelerometer. Recorded data from these sensors were translated into colours, shapes and animations that could be added as backgrounds for text messages. An unforeseen aspect of this design was that due to hardware restrictions the pen design - this was way before advanced smartphones with inbuilt accelerometers - resulted in a larger-than-intended shape, and because of its mere size some users were uncomfortable using it in public (in fact, they reported that it looked like a dildo). The question of designing 'a good grip' as discussed above, is thus not only a question of technical

functionality and ergonomics, or even how nice it feels like to hold in the hand, but also of the context of use and what kinds of activities that you like to perform, using your body, among other people. Examples from the following spreads that in different ways address this social dimension of the moving body include the GlancePhone (page 165) and the I'm your body project (page 159).

When trying to understand the role of the human body from a perspective of social performance, it is difficult not to reflect on some of the strongest taboos that we (as researchers) know of, including emotionally and morally complex, or even criminal activities that indeed have bodily pleasures and aspects of enjoyments at its core (e.g. industries surrounding sex, illegal drugs, or highly dangerous sports). Examples of research studies that touch on such issues include an analysis of the design process of sex toys (J. Bardzell & S. Bardzell 2011), and a study of the interactions involved in offenders being sentenced to wear GPS tracking anklets (Shklovski et al. 2009). However, in the field of human-computer interaction, these are highly under-explored topics, although they may generate much further insights into the full spectrum of human activity, and perhaps better understandings of what digital technology may actually do to our physical bodies.

Finally, perhaps the greatest challenge when trying to design technologies for leisure and play is that enjoyment as such is a inter-subjective and constantly shifting phenomenon, completely dependent on the attitudes among the persons involved – and thus cannot be understood only as a quality of the product itself. Yet, it is clear that some designs are better than others at triggering 'playful' modes of interactions, and become popular and appreciated by many. Along with this theme, researchers have investigated designs that explicitly have aimed for play and enjoyment, for instance by doing long-term and in-depth analysis of commercial robotic toys (page 42), different types of mobile and pervasive game designs (e.g. page 90), and interactions at the Gröna Lund Tivoli (page 32). These studies have all provided insights to the challenges of designing for bodily action, but most of all they have re-emphasised the importance of the social context in how people use, approach and enjoy technology. Even when the designs primarily address physical experiences, such as the rollercoaster or a toy, an apparent trigger for enjoyment was the presence of a surrounding social context. This observation is in a sense similar to the longstanding human discovery that it is extremely hard to tickle oneself to laughter. To sum up, enjoyment affects not only the attitudes to the things you do, it is also observed on the physical 'outside' of others, affecting everyone who is there. Thus, designing for a human body normally implies designing for a social situation.

5. Casual leisure: The luxury of having nothing to do

When designing technology for bodily experiences, it might be easy to end up focusing on sports and other physically intense activities, forgetting that most people enjoy also passive and light-effort activities, like sleeping, daydreaming, taking a stroll, and chit-chatting on the phone. These kinds of pastimes are actually quite central in how people use, and enjoy using, interactive technology – and of course these are no less physically pleasing than anything else. One way of discussing these less organised, light-effort kinds of activities is through the concept of casual leisure (Stebbins 1997), i.e. activities that tend to develop on the spot, by the participants themselves, without assumptions of a priori commitments of what exactly should be completed or performed.

When designing for leisure and play, there is an open design opportunity to make things that can fit into such lightweight and open-ended types of activities. For instance, the simple fact that people carry their mobile phones with them allows for interactive designs to become parts of very personal and habitual practices, integrating playful interactions in daily routines, in transitional 'non-places', and while waiting (Cramer et al. 2011). Some of the most popular kinds of mobile games are those that can be moved between activities, use settings and social contexts. This blurring of play and everyday life has been extensively explored in the design and study of so called pervasive games (page 90), as well as in studies on playful practices around location sharing on FourSquare (page 64), and in more general studies of mobile phone use, e.g. in the everyday uses observed in Vanuatu (page 22).

Another aspect is how, within theories of enjoyment, seemingly negative attributes of experiences are understood as critical parts of positive, playful and rewarding experiences. It is well documented in the studies of games, as well as in other leisure activities (Juhlin & Weilenmann 2008; Höök 2010; Berlyne 1968), that feelings such as boredom, pain, unfriendliness, and tension are important parts of activities that people actually enjoy. Questions that this brings about include how we, as designers, may address more negative aspects of the activities that we design for, and also challenges in terms of e.g. sensitivity to the value systems of our users and perhaps even research ethics.

Tying back to the case of laughter above, a good laugh may be an important, although perhaps extreme, aspect of playful experiences that cannot be neglected in the design of technology. And no matter what, even in less physically engaging activities, like watching a mildly entertaining TV show or telling a joke to a friend via a text message, our physical bodies are obviously still there with us, sometimes laughing loudly.

Conclusions

In this chapter I have discussed physical movement as addressed in the projects presented in this book, and why this kind of research is important to designers of new technology. The examples were sorted in five loose themes for how to think about physicality and play when designing new interactive products: bodily sensations, manual action, performance and spectatorship, digital feedback, and casual leisure. The main points concerned an orientation to people as they move their bodies and their mobile devices to different social settings, but also how a design may trigger, capture and support certain body movement, e.g. how it may be held hand and how the interaction is experienced in the bodies of users.

In research as well as commercially, different kinds of body movement in interaction design was first picked up in games, but we foresee many situations where it will be key in order to design attractive and enjoyable products overall, ranging from work settings, to family life, to learning and wellbeing. The following illustrated spreads will point further to how aspects of bodily engagement can be addressed in design as well as in explorative studies.

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