Seven Mile Boots:
The design process of a wearable art piece

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This paper outlines the design process of the project ‘Seven Mile Boots’, a wearable art piece. Using the Seven Mile Boots, a user can travel seven miles in one step and traverse virtual social spaces of communication. The piece was often perceived as product design because it draws from the experience with everyday objects: boots. By giving an overview on our three main design instruments - Guiding metaphors, prototypes and experiments – we hope to shed light on some aspects of design. Guiding metaphors are important in order to communicate and develop ideas in groups. Prototypes allow for testing a design with an audience in an experiment. The focus of this paper is on the interplay between art, design and technology in the production process.

Keywords: Media Art; Wearable Systems; Design Instruments; Metaphors; Art and Design; Experimental Design

1. Introduction

The project ‘Seven Mile Boots’ started in autumn 2001. It gradually evolved over three years of development. During this time, several aspects of the piece (nearly everything except some parts of the hardware) changed. The project started as a raw idea by Laura Beloff, currently professor for digital art at Oslo National Academy of the Arts. She proposed to do a project on mobile technology together. We quickly settled for a networked wearable piece. Laura possessed an unused Compaq iPAQ PDA. After some more thoughts on the project, we agreed to develop a talking wearable jacket. Soon we found out that we need someone in the team who is capable of designing custom electronics. Erich Berger, an artist living in Oslo, was (and is) the perfect complement for our team. Thus, we started developing a wearable piece of art in form of a jacket called ‘dresscode’.

1.2 Chronology

A fundamental discrepancy between design and art is the lack of a defined goal in the latter. In art even more than in design, the target of all efforts manifests (or emerges) slowly. This meandering progress forms a core part of the production process. Our way of reaching a certain level of coherence between team members was to establish initial metaphors of what our system might resemble in terms of the audience's experience. One of these key metaphors was the idea to build an automat that emulates the Tourette syndrome, an illness that ‘... basically consists of involuntary movements and vocalisations’ (Robertson and Baron-Cohen 1998). Therefore, our first step was to connect bodily movement to audio output. At our first workshop in Helsinki in

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January 2002 we managed to build a working prototype of a talking jacket in two weeks using the visual programming language Pure Data (Pd) on the iPAQ. An unbiased user tested the prototype and the (informal) results were disappointing. Thus, we abandoned the idea of a jacket for objects that feature a closer relation to the concept of movement: boots.

We kept nothing but the technology when we changed direction. Our new guiding metaphor was the concept of the flâneur, a stereotype described 1938 by Charles Baudelaire and later adopted by Walter Benjamin:

> The street becomes a dwelling for the flâneur; he is as much at home among the facades of houses as a citizen is in his four walls. To him the shiny, enameled signs of businesses are at least as good a wall ornament as an oil painting is to the bourgeois in his salon. (Benjamin 1973)

Using the figure of the flâneur we were able to develop an in-depth view of communicative spaces: In order to implement travelling through these, we chose Internet Relay Chat (IRC) as the source for spoken communication. The digital flanêur walks through virtual crowds. The Seven Mile Boots (see figure 1) bring together two formerly distinct (yet overlapping in the time domain) layers of communication: Physical and virtual spaces. Figuring out an aesthetically pleasing device was a prototype oriented design task. The experience of a piece of interactive art can hardly be estimated before there is an at least partly functional prototype.

[Figure 1 about here]

2. The Seven Mile Boots

Chatting in the net has become a widespread phenomenon during the last decade. There is endless communication in the online communities. Walking (wearing shoes) is an everyday exercise for humans. The Seven Mile Boots are built upon shoes as an interface to move in the text based non-space of chat rooms.

The physical part of the piece consists of a pair of boots, which are available for use. The boots have two different modes: walking through the net and observing the chat activity. They depend on no external technology but an available wireless network. The piece shifts the audience's viewpoint from the physical to the conceptual aspects of communication. It focuses on the ordinary, on everyday activities.

In the exhibition, the audience is welcome to put on the boots. We designed the transport box so that people can sit down on it to change their shoes for the Seven Mile Boots. They get a short introduction to the piece and are afterwards free to walk their way. The boots were done in two sizes, allowing for parallel use.

2.1 The Seven Mile Boots as a wearable art piece

During the production process, we never thought that we produce something labelled wearable art. We never tried to settle the piece in the rich context of wearable systems. Our driving force was that we wanted to have a voice follow the participant. We wanted to create a 'nasty' art piece that the audience cannot ignore or shake off once involved. We unconsciously emphasised aspects of wearables such as the inability of the wearer to keep distance, the feeling of touch and physical closeness.

A great deal of wearable art pieces comments on (the future of) fashion. Even more media art pieces reflect issues of communication. Only rarely an art piece tries to directly address the audience, altering their experience of social interaction in a physical way. People convey information-based and staged experiences different than haptic experiences. In her famous book Hamlet on the Holodeck, Janet Murray treats electronic media as representational (Murray 1997). The Seven Mile Boots extend the notion of representational media since the creators of the content do not know of the representational form of their contribution. In fact, the media independence of data (even information or narrativity) is one of the key points of this piece.

Our piece gained - and suffered as well - greatly from reinterpreting an everyday object. On one hand, our audience immediately knew how to use the piece. They also quickly and intuitively understood the link between speech and walking since traversing through crowds of talking people is also an everyday concept. On the other hand, it was common (especially among journalists) to read our piece as a comment on the future of fashion. Bringing technology to mundane objects seems to stimulate people's creativity. Interestingly, press coverage also revealed several misconceptions about the art piece: From mobile power sources to the functionality of an e-mail reader. Although we were expecting difficulties in communicating our ideas we underestimated the amount of imagination an art piece based on everyday objects fosters.

It also has to be spelled out that it was not our intention to create a usable interface – a tool. The artistic goal was to focus on specific properties of public conversation. Thus, a lot of the difficulties that other audio-based wearable works face lost their significance. Sawhney and Schmandt (2000) discuss a number of challenges in the design of mobile audio devices. These issues involve e.g. privacy, context-dependent (Clarkson *et al.* 1998) scaling of auditory icons. While the premise holds that audio-only communication can create a social space (Ackerman *et al.* 1997), it was our goal to effectively restrain sensitivity in creating that space. Just like everyday mobile telephone communication happens in public transport, we brought everyday communication into the exhibition halls.

3. Technical realisation

The whole installation Seven Mile Boots consists of several parts: the boots themselves, the transport box with loading station, and a wireless network access point. Since all electronics is mounted on the boots, power consumption has been one of the main issues.

It was our goal to allow the user of the system to travel through communicative channels by walking through the real world. In order to detect movement we decided against tracking systems because using those would have involved mapping the virtual space onto the real space in an arbitrary way. Instead we solely linked movement itself to virtual movement. By refusing to map spaces we made it impossible for the user to purposefully navigate the social experience. We did not intend to build an ergodic text (Aarseth 1997) but a life-like experience.

A sensor detects that the boots are put on. The software on the PDA then connects to a randomly chosen IRC (Internet Relay Chat) server. Once a few steps are taken, the first bunch of IRC channels (chat rooms) is entered. A sound indicates that channel boundaries are crossed. If there is a conversation happening in these channels it gets synthesised to speech and played through the speakers built into the boots. The wearer might decide to stay and listen to the spoken. If she continues to walk she leaves these channels and enters new ones. Once she puts off the boots, the audio fades out. The transitions between these different states are shown in figure 2. More details on the technical realisation can be found in Pichlmair (2005).

[Insert Figure 2 about here]

3.1 Hardware

The hardware for the boots was chosen according to constraints that the situations of use impose on the technology: restricted power, low weight and cheapness. A PDA offers about 3 hours of operating time when it is constantly wireless online. We chose Compaq iPAQs because of their relatively low price for used devices and the availability of the Linux operating system (in the incarnation of the Familiar Linux distribution). We ran one iPAQ 3630 and one iPAQ 3660. Our iPAQs feature 206 MHz Intel StrongARM processors with RISC architecture, 32 to 64 MB of flash memory and wireless networking cards. Audio is put out through the headphone jack, which is connected to the speakers built into the tips of the shoes. The right boot of a pair is passive and receives the right audio channel via a radio link.

There are two sensors in the left boot of each pair: The ‘closing sensor’ for detecting if the boot is worn and the ‘walking sensor’ for measuring movement. After initial experiments with photoelectric diodes, we went for a simple switch based on a press-stud for the closing sensor. We also changed the walking sensor from a light diode to an accelerometer. Both sensors are connected to a Basic Stamp microcontroller that translates the sensor data to ASCII data that gets sent to the iPAQ over a serial line.

3.2 Software

For several reasons, we chose Linux as the operating system. First, the installation takes less of the valuable memory space than the pre-installed Windows. Second, Linux is known for its stability. Third, it features a standard set of tools and easy access to low-level hardware functions.

The Familiar Linux distribution offers a variety of applications in pre-compiled form. Other software (e.g. the sound daemon and the speech synthesis system) had to be cross-compiled and deployed. We were glad to find a small Perl package for Familiar that allowed for simple prototyping and fast code adaptation.

The handcrafted software on the iPAQ runs in several parallel processes. There is one server process listening on the serial port, constantly polling for sensor data. Another one is monitoring the internal state of the iPAQ (battery life, processes and network state). The third script is a front-end to the audio server and the speech synthesis (Black 2001). Then, there is a process that connects to the IRC servers. This script is largely based on sirc, a small Perl IRC client by Roger Espel Llima. Application logic runs in yet another process, implemented as a state machine that defines the behaviour of the whole system (see figure 2).

4. Reflections on the design process

Seven Mile Boots is an art project rather than a design or engineering project (but it included several design and engineering tasks). We did not have any customers we were committed to but an audience. Our project made heavy use of pre-existing cultural knowledge: shoes are widely used objects. We did not have to fulfil any time plan but were able to choose our own pace. We sought professional service in all domains we are not professional ourselves: e.g. a cobbler from Helsinki did the leather boots.

The progress through the production process was characterised by intense working sessions and long times spent isolated from each other. We advanced mostly during the times of collaborative work. Only the more technical tasks of the project were carried out in-between (e.g. doing the shoes with the shoemaker, parts of the programming and electronics). This situation lead to the demand for well-suited communication artefacts (Perry and Sanderson 1998), a fruitful design process is probable to yield. Design artefacts serve multiple purposes: They are tools for thinking, for communicating and for storing information (Wagner 2003).

Gedenryd (1998) termed certain tools used in the design process ‘materials of inquiry’. These tools are part of ‘interactive design through inquiry’ (Gedenryd 1998). Purgathofer (2004) calls them ‘design instruments’. Examples of design instruments are sketches, scenarios and prototypes. Each design instrument imposes specific constraints on a stage (or phase) of design (Lawson 1997, Purgathofer 2004). The rough nature of the classical pen-on-paper sketch allows for a quick and fluid expression of a design, yet it fails to grasp the (e.g. visual) complexity of the resulting product. The rough sketch of a software component on paper swiftly summarises a thought on how a piece of software may be designed, yet it fails to result in a formal specification. The goal of using design instruments is to have light-weighted tools for design, rather than a heavy-weighted design methodology. Thus, design instruments form a departure from the strict design methods originally drafted by Christopher Alexander (1964) in favour of a more pragmatic approach that emphasises on the interactive aspects of design.

The relation between design instruments and design artefacts is that the instruments yield the artefacts. E.g. the act of sketching yields sketches. By carefully considering which instrument to use, and when to use a specific instrument, a body of design artefacts is created that reliably reflects the design process in concrete objects. The idea is that the correct design instrument emphasises the right properties of a design in a specific situation. A sketch on paper emphasises the basic look and organisation of e.g. a device while it shadows technical aspects. A scenario highlights the use of a device, while it does not cover the production method or technical realisation. Functional prototypes can be used to prototype the technology behind the object, but do not need to incorporate aesthetics.

4.1 Design instruments in use

In this project, we made use of sketches and prototypes as design instruments. We drew sketches for several areas of design: E.g. visual design, software design, and layout of electronics. We also used sketches to convey information about the piece to organisers and technicians of exhibition spaces as well as for internal communication and research purposes. While sketches were created during the whole design process, we had three sessions where we built and tested (functional) prototypes. These sessions involved an audience. In the first user testing session we invited an artist friend to test out the piece. As pointed out in the introduction, the analysis of the session's results ruled out the jacket in favour of the boots. The second user prototype was created after a month of full time work on the piece. We invited one of Laura's university colleagues to have a look at the working prototype. We were able to detect and reject a number of possible wrong future directions of development after this review of the piece. This second session greatly helped in focusing the piece. The third experiment took place in form of an exhibition in Kunstnernes Hus, Oslo. We had real museum audience instead of invited professionals. The echo was mixed. Our observation was that the audience primarily objected technical flaws while adoring the piece's concept. From this first exhibition on, we saw every public event as an experiment - a prototyping session that helps us to understand the aesthetic, social and technical implications of our art piece.

4.2 Guiding metaphors as design instruments

Above, we described the guiding metaphor of the flanêur. The description of the flanêur (Benjamin 1973) is a description of how a flanêur behaves rather than what a flanêur is. It highlights the dynamic and interactive properties of a person's behaviour. Because of that, the metaphor is so perfectly suited as a guiding metaphor.
A guiding metaphor is constructed from a circumstance allowing for research – such as the description of a person, animal or plant in a specific situation. Metaphors consist of two parts: one model in the source domain and one in the target domain. A metaphor establishes 'understanding and experiencing one kind of thing in terms of another' (Lakoff & Johnson 1980, p.5). In the case of the guiding metaphor, the interactivity that a user experiences is modelled after a preceding case that is taken from a different domain. The key is that the model is regarded as an archetype. The object to be built approaches this archetype. The interactivity of the system is a translation of the model's interactivity into the particular domain of the target system. Thus, new designs of interactive systems can be developed guided by an abstract – or at least remote – metaphoric ideal.
If properly used, guiding metaphors form a design instrument. They are light-weighted because the domain they come from can be chosen to be familiar to the designer. They emphasis playful interaction since they open up a communicative (and cognitive) space the designer can wander. Additionally, they allow gradual refinement, because both of their parts – the source model and the mapping into the target domain – can be resolved in more detail if needed. Among other aspects, this fact qualifies them as design instruments.

5. Conclusion

Art projects differ significantly from design projects. Restrictions like customer requirements and demanded technical capabilities do not apply. Lawson (1997) extensively discusses constraints in design projects. Constraints in art projects are often financial or technical and sometimes social phenomena. Progressing by interactive inquiry (Gedenryd 1998, Purgathofer 2004) was a fruitful effort for us. Sketches, prototypes, experiments, and metaphors turned out to be the key to success in our project. We relied heavily on these design instruments.

Since the Seven Mile Boots never matured so far that they could be turned into a mass-produced product, the art piece itself remains a prototype. We still develop it further between the exhibitions. It will never be finished and thus we see it as an open process – just like communication itself is continuously evolving and mutating. The same holds true for the interpretation of the art piece: new ways of reading the piece emerge with every exhibition. Thus, the design process of this piece will never end.

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Figure captions:
Figure 1. The Seven Mile Boots
Figure 2. Different states of the boots. State transitions are triggered by the user.

Short Title:
Seven Mile Boots