what could be the role of analogue, textiles user-interfaces in the digital age?
1 Abstract

This thesis discusses the role of e-textiles as user-interfaces and their properties in
difference to common interfaces such as buttons or touch-screens for example.

An introduction to my motivation will be given, including my view on society and on
our relation to nature and technical devices, as well as the problems I see coming
along with it, for example regarding the perception of time. As a theoretical back-
ground Foucault’s panopticism will be mentioned. After the introduction, the research-
question and aim will be explained, the research outline will be drawn and the context
of the research regarding other projects and investigations in my field. Two of my
previous projects from this research will be mentioned and will conduct to how I came
to critical design.
The field of critical design and interdisciplinary critical actionism will frame the position
of the final project of the thesis. After that, an overview of the working process,
including design methods, artistic methods and timing, will be given and sums up with
a short reflection on it.
The final project will be presented with the scenario of my project. The reports closes
with a reflection on outcome, the design process and a perspective of future research.
# Index

1 Abstract 3
   notes 6

2 Introduction 7
   2.1 Motivation 7
      2.1.1 Feedback-less Interaction 7
      2.1.2 Open Processes in Nature 7
      2.1.3 A Pulsing Society 8
      2.1.4 User-Interfaces 8
      2.1.5 New Materials 8
      2.1.6 Considerations 8
   2.2 Research-question and Aim 9
      2.2.1 Context of Research-Question : Tangible User Interfaces 9
   2.3 Previous Projects 12
      2.3.1 Lichen 12
      2.3.2 Do you like that pace? 13
      2.3.3 Reflection and Discussion on Previous Projects 14

3 Process of YOUR BALANCE 15
   3.1 Project Outline 15
   3.2 Surveillance and E-textiles 15
   3.3 Critical Design 19
   3.4 Adressing of the Project and Context 22

4 Methods and Process 23
   4.1 Critical Design Methods 23
   4.2 Aesthetic Design Methods 25
   4.3 Technical Design Methods 25
   4.4 Material and Textile Design Methods 26
   4.5 Interaction Methods 26
   4.6 BREAK!-Reflection 26
   4.7 Timing 28
   4.8 Reflecting on the Methods 33

5 YOUR BALANCE 35

6 Reflection 40
   acknowledgements 42
   references 43
analogue (US also analog) n a person or thing seeing analogue – adj relating or using information represented by continuously variable physical quantity (such as spacial position, voltage etc) rather than digitally.
ORIGIN via L. from Gk anlogos ,proportionate’

artificial 1. made as a copy of something natural
2. contrived or affected artificially
3. Bridge (of a bid) conventional as opposite to natural
artificial adj. L- artificialis, ,pertaining to art, artificial’ ►fr. artificium artifice 1)skill 2) trickery fr.L artificium ,handicraft, skill, ingenuity, dexterity; craft, cunning, device’ from artifex

digital 1. relating to or using signals of information represented as digits using direct values of a physical quantity such as voltage or magneticpolarisation.
Compare with ANALOGUE > (of a clock or watch)rather than hands or pointer. Showing the time by means of displayed digits 2. of or relating to a finger or fingers

digital age Era in which online and digital device and communication becomes daily life tool and habit.

e-textiles Conductive and programmable textile materials, structures and artefacts

nature
1. n the phenomena of the physical world collectively including plants, animals and landscape, as opposed to humans or human creations. > the physical force regarded as causing and regulating these phenomena >archaic a living thing’s vital functions or needs
2. the basic of inherent features, qualities, or character of a persona and thing > inborn or hereditary characteristics as an influence on or determinant of personality
nature n-ME.,fr. OF(=F) nature fr.L nātūra, nature, natural character of a thing, natural disposition, the course of things, universe, lit. birth fr. nātūs ,born‘ pp of nāser ,to be born‘, (see nation and cp nascent,natural,native)

radical design design movement of the 1960s that is breaking with the rules of functionality of design and questions traditional design rules such as “form follows function”.
2 Introduction

2.1 Motivation

Textile as daily life objects appear as “soft, warm, memorable and close to our bodies, technological devices often feels quite opposite” (J. Redström in IT+Textiles)\(^1\).

2.1.1 Feedback-less interaction
I try do find out the perceptive role that textiles can take as an interface to digital devices in our daily surrounding, and what they are capable in opposite to digital, electronic devices. I want to discuss the relation of technical devices and their effect for human beings’ everyday life. What are the essential perceptive problems with common digital devices, their user-interfaces and interaction with them? Which role does the nature and the sensorial experience of textiles take in the digital age?
I made an interview With Erwin Heller from the Society for the deceleration of time\(^2\). We discussed attitudes and problems of the society in the digital age. He said that a main reason for our problems with time is the construction of our minds based on former times when humans lived with a lack of possibilities. He told me his view that nowadays, in civilized cultures, we have a lot of possibilities regarding consumer goods, communication and events. Since the mind is programmed for the situation of lack, we get confused and struggle, because it will never be possible to catch all the possibilities. This can occur as stress and may follow as symptoms on our physical and psychological health.
The living pace of the digital age makes it difficult for us to digest sensorial impressions and experiences. Regarding the past, a lack of possibilities can make a situation rich and memorable, for example waiting for an important phone-call. If we have the comparability of positive and negative moments, we are able to realize them emotionally and in the time-context. Possible problems with digital media are that they offer a lot of possibilities, and they are often mobile and always with us, so that we get more and more to the state of having always a lot of possibilities. We just accept that those possibilities are always with us, and that they can reach us any time. With the old structures in our minds, we have a continuous conflict of trying to catch all the possibilities.

2.1.2 Open processes in Nature
The interview left one very important thought: “the central human point is the fallibility“.

\(^1\) IT+Textiles, Redström, M, Redström, Mazé R, Helsinki 2005
\(^2\) Interview by Barbro Scholz, München 2011, (private collection)
As Barbara Adam\(^3\) says: “The human being is not just in the nature, he is nature.” Changes in nature happen because of rhythmical repetition of similarities, but never of exactly the same process. Comparing now digital with nature processes, „the digital ones are monotone, repeating ones.“ (Erwin Heller in the interview) We are used to use internet and other digital techniques which provide us a lot of mobile services. At the same time: We like nature. We feel good to be outside in nature, in the forest, by the sea, to take care of plants or animals. Natural processes, which maybe could be called analogue, seem to feel more natural for us as human beings.

### 2.1.3 A Pulsing Society

On the other hand, internet, e-mails, smart phones and laptops result a dynamic with fast pace. Being available all the time causes the feeling of obligation. It seems to be productive, but we spend a lot of time being occupied with digital information. Pulsing of life has been more and more regulated by technical devices with exact timing in equal units, which are plan-able. For example a digital music instrument which is limited to the programmed parameters.

But how can we find our place in between our needs of using our senses and the demands in daily life? How can we deal with monotone repetition of digital processes of our devices of daily life and our origin in fallible natural process? It seems that the pace of logistics of information and transport has increased. Today we often accept a range of abstract actions given by technical devices and forget the option to choose consciously which pace we allow in our life and how much time we spend for certain daily life actions that is not regulated by technical devices. We use a lot of devices without getting a proper physical feedback of what we are actually doing. Without sensorial feedback, our mind has no stimulation “to digest”, we are not recognizing the incidents and are loosing the sensorial experience of things. By not having a stimulation in mind, no memory to the incidents, our minds cannot find a reference to categorize and we may feel lost.

### 2.1.4 User-Interfaces

My background in industrial design includes experience with user-interfaces and their possibilities on different levels. I think it makes sense to think very much about the human being who is going to interact with an object or product. An object and its interaction that is easy to understand, can make it easier for the user to make a relation to the object.\(^4\)

---

\(^3\) Zeit ist mehr als Geld Prof. Adam, Barbara, Cardiff, Wales, Leitner B dradio Berlin 2010

\(^4\) IDEO Human Centered Design Kit, IDEO, 2009
2.1.5 New Materials
I see possibilities in new materials such as e-textiles. Working as a designer in the stage of research and development, opens the possibility to influence terms of what is considered as human friendly. That includes also sustainability, being able to use environmental strategies and end-of-life implications that can be considered in an early stage by doing research as a designer. Marcus Wendin from Miljögiraff\(^5\) says that 80% of the emissions of a product can be reduced in the design-process.

2.1.6 Considerations
After having worked with the theme and e-textiles for time of the thesis, I still wonder what is actually the role of textiles regarding input and output devices. The problems with digital devices seem not to be caused by materials and a good interface-design-solution. I think instead it has very much to do with the attitude of humans, which passively accepts given technology. Today many of our daily devices are used for both professional and private life. By that, online-services can reach people any time which can prohibit stress.

At the starting point of my final thesis project, I wonder what is the role of textiles as user-interfaces, but I also wonder what does it actually change?

2.2 Research-Question and Aim
-What could be the role of textile as analogue user interfaces in the digital age?

I try do find out the perceptive role that textiles can take in our daily surrounding as user interfaces, and what they do in opposite to digital input-devices. How can technical devices together with our attitudes support our stressful life style? I want to investigate the essential problems with the perception of usual digital devices, their user-interfaces and interaction with them. I consider people’s awareness and how it could be supported by using textiles and if the interaction with a textile user-interface is less abstract and closer to our natural expectation of sensorial experience. Which interactions happens unconscious, which conscious?

I wanted to find out, how much the designer can lead or change attitudes of the user through interaction. Does that lead to paternalism and to less awareness of the actions? Probably automatism leads to less awareness. What is the difference between touching a button or a textile? I want to know, if interaction with an analogue interface made of textile is changing our relation to electronic devices.

2.2.1 Context of Research-Question : Tangible User Interfaces
The era that is commonly called digital age, or information age, means the period of de-

\(^5\) www.miljögiraff.se, Göteborg 2012
development of information logistics through digital devices. In general the term means the advent of personal computer in the late 1970s as a starting point until now and into the future. The minimization of the computer into smart phones and the distribution of digital devices in the society have lead to new design questions.6

Interfaces for human-computer-interaction, can be graphical user interfaces, which provides the surface of interaction as for example a homepage or a display of an automatic machine. That contains a 2D-surface with an input-device such as a computer mouse or finger if it is a touch-screens. Interface and interaction designers have discussed about opportunities of tangible user interfaces (TUI). A TUI allows the user to interact with digital information through physical objects. Designers have been discussing TUIs in terms of human centred design, as a less abstract way to communicate with a device through a physical object. As the start up for my master thesis, I propose that textiles, with their sensorial characteristics, could be an alternative TUI for current feedback-less communication-devices. I will give some examples of TUIs and textile TUIs to point out and to discuss their properties.

The ReacTable(fig1) is one example of TUI for digital music devices. It is an interactive

---

6 “Human-Computer Interaction in the New Millenium,” John M. Carroll, ed.; © Addison-Wesley, August 2001
music instrument in shape of a table which can be played by moving different tagged objects, representing sound generators, on the table top. By turning, moving and combining them, the represented sound generators are combined and creates electronic sound signals. It allows an intuitive interaction with a digital device and provides intuitive understanding since input and output happens in analogue relation to each other and are also displayed through graphics.

Another example for a TUI is the I/O Brush (fig 2) of a K. Ryokai, S. Marti and H. Ishii from the Media Lab at the MIT.\(^7\) The I/O Brush allows the user to paint digital pictures with help of his physical environment. “I/O Brush looks like a regular physical paintbrush but has a small video camera with lights and touch sensors embedded inside. Outside of the drawing canvas, the brush can pick up colour, texture, and movement of a brushed surface. On the canvas, artists can draw with the special „ink“ they just picked up from their immediate environment.”.

The I/O Brush connects the physical world directly with the digital painting tool. The experience of the physical surrounding is included, because the painting is not limited by fixed colours, the artist has to create the palette by seeing the physical objects around him. That makes it possible for the mind to register and digest the interaction with the digital device. The device in shape of a known object for painting, let us use the interface intuitively. This project touches the discussion of understanding technical devices because of analogies to physical objects that we know.

In several e-textile projects, this intention is used and developed as a TUI, made of materials that we experience as soft and sensorial. By making a textile wearable TUI, the interaction can be combined with human social interaction. For example, the Hug Shirt (fig 3) by CuteCircuit consisting of a with Bluetooth communicating input-device and sensors embedded in a shirt. It can be connected to mobile phones to send data. The input is a touch of the sensor areas at the shirt, the intensity and the duration of the hug, the heart rate and the temperature of the hugging person is monitored and relayed to the receivers shirt.

The use of textiles as user inter-faces can make the interaction with digital information more understandable for the human being. In the ReacTable, the information is analogue to the input, visualisation supports the understanding of the interaction. The transferred information in the Hug Shirt is more abstract, since it is unconsciously sent by the body. But it is also a new way of using digital devices, personalized non-verbal communication to awake an emotion. The Hug Shirt as well as the I/O Brush are using known physical objects to make the interaction with the digital device intuitively understandable.

---

\(^7\) Designing the World as Your Palette Ryokai, K., Marti, S., Ishii, H. 2005
2.3 Previous Projects

2.3.1 Lichen

This project deals with the interpretation of an organism from nature into knitted textiles that can be used as sensors. The character of the organism, the lichen, should correspond the functionality and interaction with the fabric as a textile input device. I studied lichen in terms of expression but also the organism itself. That means that I transformed characters of the lichen to my textiles. I chose some keywords belonging to their surfaces as dry (handle), raspy, crispy, scaly, and also their colours and the way they extend: round forms, some more as spots and some like one growing piece. Lichen are slowly growing, they adapt, place after the underground surface and take over the surface. They take on the changes of their environment and „digest“ them...
slowly. Its organism is, in long term, a reflection of the surrounding.
I used the colours and the expression of lichen, and also their live cycle of taking over a surface, being shaped by the surfaces they grow on. They are very nondescript in their appearance in nature, but have diverse ranges of colours and shapes. Lichen are a symbiosis of mushrooms (the mycobiont) with a photosynthetic partner (the photobiont or phycobiont). They grow slowly and are indicators for their environment and surrounding. They are formed by the surface they grow on. They are physically fragile, but can grow in extreme climate for example on 5000m, in -47°C or 80°C, in the desert and in water. Reproduction and nurturing happens through the air:
The development of the knit-pattern was done by using the technique of “false lace”, in which a knit with two yarns is done. The patterns is constructed by parts where both yarns are knit, in other parts just the first yarn is making loops. This gives a visual effect of a lace-like structure when it is knitted with a thin first yarn and a thicker second yarn. By experimenting with different yarns as first and second yarns, three-dimensional surfaces were created. The pattern drawn in the computer is always the same, just the choice of material, for example elasthane as a first one, changes the outcome.(fig4) These textiles are a mixture of ordinary yarns and conductive yarns.
The implementation of the conductive yarn into the knit is an interpretation of the symbiosis within a lichen organism. The knit provides the way the sensor is working. For example, the picture (fig 5) shows an elastic, three-dimensional structure that works as a pressure sensor, it can be stepped on or be pressed by the hand or with the whole body. It is made of elasthane as a first thread and cotton yarn with conductive yarn as the second thread. The second textile, (fig 6) is a very fragile, thin and light structured textile and it consists of several thin cotton threads and a conductive yarn. It reacts on stretching and crumbling as conductive yarn changes its electrical resistance as it is stretched(fig 7). The third pattern is also elastic, but takes up the scaly expression of the lichen with loops. Because of the loops, the surface of the fabric is loose and works as a tickle-sensor.

2.3.2 Do you like that pace?
*Do you like that pace?* is a textile interface made of common felt and conductive felt, working as a slowly heatable structure with thermo-chromic print to display an undefined time-frame. It is analogue, and gives feedback to the user while interacting with it: Through touching the heating surface, the way of connection of the electricity is changed and the pattern is manipulated. This project was developed at the TITV, the Textile Research Institute Thuringia Vogtland.(fig 8) *Do you like that pace?* shows movement in time, but not in measurement units putting the moment into a temporal context to our routines. One can physically take “his time”, one or more panels. It can be arranged as a bigger display or used one by one. It can just be watched but also
played with. The movement of the warming patterns can be manipulated with the hands, the change happens analogue to the movement, the pace of the movement is defined by the material properties. Within the project, a research on heatable felted surfaces was been done regarding combination of heating fibres in plemented in wool and their properties. The research and the tests were done in the electronic lab of the TITV.

Focus in this project was on the perception of time, how time is giving a pulsing to everyday life. (fig 9, 10)

2.3.3 Reflection and discussion on previous projects

_Lichen_ and _Do you like that pace?_ have some different character. The knit is a flexible structure done by the systematic of the knitting pattern. Through material change, the outcome was diverse. Testing the textile sensors, it was shown that their appearance leads people to interact in a certain way. For example, the pressure sensor with its three-dimensional surface invites to press and to experence the complexibility in the structure.

The knitted sensors can be used in different contexts as an input-device. They can be used both in a conscious way as an interface-device, but also unconscious in a garment.

The time-interface included a systematic investigation of material blends and their properties, but the textile process of felting was less controllable, as the structure and how the fibres will finally be placed relates to the shrinking of the wool which I could just manipulate in terms of density. Though, with the embroidery, I could control the function of the interfaces systematically with the structure of the embroidered pattern.

In opposite to the knitted sensors, the time-interface including input and output became a stand-alone object that deals with the time and pulsing in the digital age.

In previous projects, I tried to find an answer how textiles could be used to design a alternative human experience with digital devices. The outcome was that it didn’t seem to matter which cognitive experience, which textile tangible user-interface I created, I can not change the user, if he is not interested. It is possible to manipulate the way the user is interacting with the interface in terms of pace and expression through the choice of materials and speed of input and output of their relation. Observing people trying out the interfaces of _Lichen_ and _Do you like that pace?_ people seem to enjoy the tactile experience. The interaction is intuitively, since the textiles attract to be touched and the output is analogue to the input, the user can understand the way of use without knowing the device from before.

I want to find out, what could be the role of textile, analogue interfaces in the digital
age. The result of the first projects was, that I can change the interaction and the way a user-interface can be, but that I cannot change the awareness of people. That frustration lead to use critical design, since I cannot give an answer on the question. Critical design will be used as a method to forward the question to the spectator. The outcome will be an analogue, textile user interface, which is pointing out the problem by asking a critical question through a scenario and design-objects instead of proposing a solution.

3 Process of YOUR BALANCE

3.1 Project-Outline
Your balance is a collection of e-textile monitoring devices for companies to check their employee’s status of life-balance. To be efficiently balanced between moving and resting: Are the user’s movements too slow, or too hectic? Are there too many actions with one part of the body, or too little with another part? The scenario of this project suggests that they will be monitored by a network connected to the company the user works for. To avoid being analysed in the wrong way, the monitoring device requires the user to act in a certain way. Since the sensors are worn always, all moves has to be clearly recognized by the system to give an accurate image of the user’s balance to himself and the company.

3.2 Surveillance and E-textiles
The following are some examples of e-textile projects from the regarding sensor-application in garments and interior and discuss automatised applications of control. The first example is about abuse-sensing garments by Yolita Nugent here. The garments embed pressure-sensors, which track data such as amount of force and time between change of data impulse which will be recorded by a monitoring system. Parents can
monitor the children’s whereabouts and activities, to control if the child has been hit by another person, such as another child or an adult.

Another example is the research project *Scentsory Design* by Jenny Tillotson. Her research is about developing a sensory platform in which interactive clothes worn by the user and interactive environment can communicate and react on each other. It includes an emotional wardrobe which is capable of communicating with “wallpaper”. The “wallpaper” is applied to the environment like a wallpaper. Fragrances and colours are activated by wireless data-signals, transmitted from the user’s garment. By fusing the textile and the wearer, Tillotson creates a responsive, multi sensory environment that bridges the distance between wearable *Smart Skin* and surfaces surrounding it. The aim of the project is to promote and elevate emotional states and foster a feeling of well being.

One part of the research project the **Less Stress Dress**: The dress embeds a network of sensors, which will create a secret aromatherapy according to the wearer’s mood. The sensors detect a rise in stress levels and emits neroli, which is a flower-based fragrances that is supposed to lower blood pressure. The interaction with the *Scensory Design* happens on a subconscious level and could be tagged as automatism. It is not meant to make the user participate actively, it is an aid-kit taking over the task of watching a person’s well-being.

Yolita Nugent’s project implements the thought that the more control it provides the better your life become. Parents will get help to feel “good parents” through controlling their children’s life so that they can help them any time. The implementation of the technology into textile provides invisible surveillance possibilities. Considering e-textiles as surveillance devices, they can be very helpful in medical context such as for example observing patients in health-care, for example the *sense-floor* by futureLab.

When considering e-textiles as surveillance devices, the following questions arises: Who decides who is needing “help” by a surveillance-application? Who is controlling the persons and who is deciding the aid that is given to them?

In case of surveillance in some kind of community, textiles with invisible surveillance-functions makes the fear of doing everything “right” even bigger.

Also the **Less Stress Dress** is providing a help-application. It could be questioned if it makes sense to work on the symptoms instead of the reason of not feeling well. The automatism of the choice of aromes could lead to problems, since humans are not all the same and maybe the chosen one is not helping the person at all. An overall topic of surveillance-applications is that they are easy to misuse. Taking the **Less Stress Dress** as an example, in the same way it can be used to make people feel better through aromatherapy, other fragrances could be used to make people feel weak.

An example from history is the Panopticon by Jeremy Benthon from the late eighteenth century as a metaphor. The panopticism found by Michel Foucault is discusses
the background of efficiency-thinking. The Panopticon was designed as an architectural concept for prisons, but could be used as buildings such as schools, workshops or factories to enable surveillance of many people at the same time by one observer. (fig 11)

8“The architecture incorporates a tower central to a circular building that is divided into cells, each cell extending the entire thickness of the building to allow inner and outer windows. The occupants of the cells are thus backlit, isolated from one another by walls, and subject to scrutiny both collectively and individually by an observer in the tower who remains unseen. Toward this end, Bentham envisioned not only venetian blinds on the tower observation ports but also maze-like connections among tower rooms to avoid glints of light or noise that might betray the presence of an observer” —Ben and Marthalee Barton

This architectural concept has later been discussed as a metaphor in Michel Foucault’s “Discipline and Punish: The birth of Prison” (NY 1995) in which he found the term panopticism. Foucault sees these principles of order as fundamental for western societies, which he is calling “society of discipline”.

The discipline provides economic efficiency regarding behaviour, production, education and to realise regulations for example in prisons. In total, they provide the most efficient outcome of every individual. The discipline brands terms such as mad/sane, harmless/dangerous, normal/abnormal. It is more efficient than a system just based on punishment. Panopticism works from inside the body of society:

“[...]it is not that the beautiful totality of the individual is amputated, repressed, altered by our social order it is rather that the individual is carefully fabricated in it, according to a whole technique of forces and bodies.”9 as Foucault says in Discipline and Punish. Discipline controls the society in a political system and makes it easier to keep the power of the major: “that is why discipline fixes; it arrests or regulates movements; it clears up confusion; it dissipates compact groupings of individuals wandering about the country in unpredictable ways; it establishes calculated


9 Discipline & Punish: The Birth of the Prison Foucault, Michel NY 1995 pp. 195-228
distributions.”\textsuperscript{10}(Foucault)
He even describes how discipline is implemented in several contexts of our daily life:
"Hence, in order to extract from bodies the maximum time and force, for use of these overall methods known as time-tables, collective training, exercises, total and detailed surveillance.”\textsuperscript{11}

Gilles Deleuze goes even further: he refers directly to Foucault, but calls „the society of discipline“ the „society of control“. Regarding the technical possibilities that we have today to make a panopticon, the control is stronger through the subtle way it makes people join the control systems. The following quote shows, how he thinks humans are seen in the society: „The numerical language of control is made of codes that mark access to information, or reject it. We no longer find ourselves dealing with the mass/individual pair. Individuals have become „dividuals“, and masses, samples, data, markets or „banks“."\textsuperscript{12}

I think the discipline with its values of efficiency has been implemented in all life-areas, even in private life. What would textile user-interfaces change? Will they make us more aware of our choices of time and retreat, on our attitudes as an individual? By using e-textiles for the outcome the function is even more implemented and even more closer to the body and take off their appearance of a technical device.

As I discussed before, the implementation of technology into textiles makes it invisible. It is implemented, but attached as an external application. It is communication with the user, which means that the awareness of wearing the application could be there. The surveillance it implemented in a positive context here, as a helpful connection, between employer and employee, as an attractive application showing the status of life-balance. My critical position is towards the passive acceptance of applications of control and the implementation of the values of the disciplined society including efficiency to all parts of our life. An digital communication using the concept of the Panopticon gives power let us live with the presence of control and with attitudes to please the system-requirements. Why do we accept that our retreat is questioned?
E-textiles makes implemented monitoring applications possible. The invisible technique could be in any textile, which leads to an overall change of attitudes even if techniques is actually not implemented, such as in the concept of the panopticon. Since textiles are tagged as close to the body, e-textile applications insert into privacy can raise the question of ethics in surveillance maybe even more than a common technological device. Regarding the e-textile example, it bellongs very much to the

\textsuperscript{10} Discipline & Punish: The Birth of the Prison Foucault, Michel NY 1995 pp. 195-228
\textsuperscript{11} Discipline & Punish: The Birth of the Prison Foucault, Michel NY 1995 pp. 195-228
\textsuperscript{12} Postscript on the Societies of Control Deleuze, Gilles, 1992
construction of the monitoring system if it is called surveillance or not.

3.3 Critical Design

Critical work in design has existed since the 1970s, but named as *critical design*, was done by Anthony Dunne a professor at Design Interactions at the Royal College of Art in London and Fiona Raby, professor of Industrial Design at the University of Applied Arts in Vienna. The context of the technological development during the last decades and the effects on society, the critical work in design got another meaning than just protesting against bourgeoisie, as it has been in the 1970s. It discusses our everyday-life-situations and wants to motivate implement ourselves in the creation for the future.\(^{13}\)

With the Italian Radical Design in the 1970s social values and design ideologies has been discussed. A lot of designers have worked with it for example Gaetano Pesce with the furniture series “Up”.\(^{14}\) In the 1990s there was a general move towards conceptual design supporting non-commercial forms of design, like *critical design*. It was happening mainly in the field of furniture design, since product design is closely linked to the mass market and consumerism approach. The term *critical design* was first used in Anthony Dunne’s book ‘Hertzian Tales’ (1999) and later in ‘Design Noir’ (2001).

“Critical Design uses speculative design proposals to challenge narrow assumptions, preconceptions and givens about the role products play in everyday life.”\(^{15}\)

By naming it as something critical, it gets more attention in public and opens debate and discussion.\(^{16}\) (both Dunne&Raby, 2006) In a society that is very much orientated on commercial aspects, *critical design* wants to point the relevance to the complex technological, political, economic and social changes we were experiencing during the last decades. It wants to make people reflect, to “raise awareness, exposing assumptions, provoking action, sparking debate, even entertaining in an intellectual sort of way, like literature or film”\(^{17}\) (Dunne&Raby, 2006).

Humour in form of satire is used and important to catch people’s awareness. The opinion of the designer should not be shown in the artefact. “The viewer should experience a dilemma, is it serious or not? Real or not? For *critical design* to be successful they need to make up their own mind.”\(^{18}\) *Critical design* should not end up in sophisticated design entertainment. It is important to avoid to be jokey, which can be done by working

---


\(^{14}\) Memphis Fitoussi, B London 1998

\(^{15}\) Hertzian Tales Dunne, A, MIT Press 1999


with complex and challenging issues. Critical design is future forecasting benefit and makes abstract issues tangible; it can take a role in public debates social, cultural, ethical impact on everyday life of emerging and future technologies. Critical design is not art, it may borrow terms and methods from arts. But it uses design with mass-production approach as a medium to create a comment. It should appear in in-between spaces, and should neither be too weird or too normal to make it understandable. As design it is more disturbing because it is concerning us directly, it is easier to distance from art as to a something that is not seen as reality.

It can be quite dark, but is not meant to be pessimistic. It shows human real faces. In common design, human are seen as obedient and predictable. But as realized in a lot of other disciplines, human are complex, contradictory and may even neurotic. Critical Design questions the limited emotional and psychological experiences of using designed products. The aim in commercial design, to make all things nice, is leading us away from the not nice and un-beautiful aspects of human complexity.

In critical design, the negativity should be used in a positive way, to wake attention to a scary option in form of a cautionary story.

Again: Critical design wants to put up questions, instead of finding solutions. The human being is seen as a citizen, not as a consumer. It is meant to make us think by finding
problems, instead of making us buy to solve problems. Talking about critical design the role of para-functionality and ambiguity has to be shown up. As quoted before, the viewer should experience a dilemma’, also in the way of feeling attracted by the design-object, but in a moment of irritation, he will be caught, confronted with his own behaviour. The following examples shows the ways, in which imagination and ambiguity is used in critical design: sense-fiction as an imagination of use, and social-fiction as a narrative found by causality, to illustrate how human would probably act.

The project „100% Porcelain“ by Damien O’Sullivan is a project dealing with beauty of imperfection, and with design for elderly people(fig 12). It is as series of beautiful prosthesis made of high quality porcelain. The para-functionality is, that the spectator probably sympathise with the idea, to do a nice looking product for a human limitation and for a target group, that is not „hip“. The products look very beautiful, with the traditional floral pattern on the porcelain. If the spectator thinks one step further, he will wonder why don’t we spend more effort on designing more aesthetic prosthesis-products, why do we give a low value to something, that is an everyday-thing for some people?

Another example explaining sense-fiction: The electro draught from the placebo-series by Dunne&Raby is presented as a case-study for a real product. The narratives about the ‘secret life‘ of electronic objects - both of existing facts and invented ones.(fig 13)

The electro draught is actually not working at all. It is a device with a somehow functional appearance which is meant to protect the user from electro-magnetic waves. It opens up a narrative about the fear in society, that electromagnetic fields are dangerous for us. At the same time it shows up that preventive, solute products can be placebo, their function is not tangible as the problem of electro-smog. Another example is Cleanliness Is Next To Godliness (fig 14)by studio Makkink and Bey presented with the designers’ words: “

In today’s Western society, time has become an expensive commodity that leads us to demand everything to be low-maintenance and easy to clean. There is an urgent need for a new appreciation of the care and devotion involved in housework. In China, Communist propaganda posters used to feature smart, well-groomed workers with radiant smiles. Appreciation of the value of cleaning could be similarly promoted by producing cleaning tools in luxurious materials, adorned with delicate visual images that convey a message of appreciation and care for objects around us. The products range Cleanliness Is Next To Godliness has been decorated with five domestic scenes that celebrate the value of housework.”

The narrative of this product is telling about well-designed products, making the customer happy to use them. Do they? And which kind of products should exist in luxurious version? By naming the picture of a Chinese worker in the project-description, by using an example of anti-capitalism system, the

19 http://www.studiomakkinkbey.nl/ 13/04/2010
project is immediately brought into the direction of consumption critics. It is showing up, how consumption tells us a tale about payable values.

Critical design gives, especially today in times of over-floating society, a good position to use design and utility to comment on our behaviour in the range of everyday products. E-textiles are even more implemented and even more closer to the body and take off their appearance of a technical device. They allow to open the question of surveillance and help-application, to ask the spectator what could be the role of textiles as an analogue user-interface. Critical position is used in my project to question the passive acceptance of applications of control and the implementation of the values of the disciplined society to all parts of our life.

3.4 Context of Addressing and Use

In general, critical design is made to be shown in exhibition context, it is not made to be sold and produced as a consumer-product. Design is used as a medium to communicate a question. For example, a company like IDEO\textsuperscript{20}, that works with holistic human centred design concepts, could use a critical design concept as inspiration for a new, affirmative design project. Future trend-offices, trying to forecast some years ahead, could use the critical design scenario to ask questions that are socially relevant. The designer of the critical concept shows reflection on an innovation, and shows that he is able to think two steps ahead instead of just one.

Thinking about the inter disciplinary research group behind the society of deceleration of time, critical design as scenarios to consider in discussion about change of society for example. Critical design asks questions about the world we live in, about our consumption attitudes. Regarding sustainable questions that are asked in design today, reflecting on consumptions attitudes is an important factor in the design process.

\textsuperscript{20} http://www.ideo.com 13/04/2010

Critical
Problem finding
Asks questions
Design for debate
Design as medium
In the service of society
Functional fictions
For how the world could be
Change us to suit the world
Social fiction
Parallel worlds
The “Unreal” Real
Narratives of consumption
Implications
Humour
Provocation
Conceptual design
Citizen
Makes us think
Rhetoric
Ethics
Authorship

Affirmative
Problem solving
Provides answers
Design for production
Design as solution
In the service of industry
Fictional functions
For how the world is
Change the world to suit us
Science fiction
Futures
The “Real” Real
Narratives of production
Applications
Fun
Innovation
Consumer
Concept design
Citizen
Makes us buy
Ergonomics
User-friendliness
Process

fig 15 List affirmative-critical

fig 16 Marker Sketches
4 Methods and Process

4.1 Critical design methods

Working on the concept, a list of words (fig 15), what critical design is in opposite to affirmative design, was used to check always if the project fulfills the criteria of critical design. Regarding for example a term such as „problem solving“ on the left side of the list, the corresponding term „problem finding“ is shown. Like that, every part of the concept could be considered in opposite to common product design. Since design is used as a media, it is important to understand the meaning of the product design approach to translate it to the critical concept. With the checklist it could be considered if the layer of ambiguity is working, to keep the balance of functionality and para-functionality, of humorous but not jokey. Examples of critical design projects were used to analyse how designers had worked with the critical design criteria and how they made up the scenario of the context. To make up the scenario, story-telling had to be done to communicate the social fiction. It planned how the scenario should be communicated.
4.2 Aesthetic design methods
Inspiration for the textile sensors are taken from insects, to give an ambiguous link to nature: Our actions in the digital world are claimed to may be unnatural, so maybe a little bit more of nature would help? Are we like worker bees, communicating through certain movement? The antennas of the insect’s are the orientation for how the sensors will look like, which structures will be use for the surface of this input-device. For the aesthetic design of the object, schematic drawings form biology books of antennas of insects were studied by doing marker sketches, starting to think about the materialization with the textiles. (fig 16) A first series of mock-ups was done and evaluated, in terms of function and placing on the body. Common movements and situations were observed to consider of types and shapes of the sensors (fig 17a-f) To make up more clear pictures and to catch the desired aesthetics of the application, pencil drawings were done(fig 18). The circuit that was developed on the breadboard had to be translated into a design(fig 19, 20).

4.3 Technical design methods
First material tests were done, regarding look and function. After that, material-sketches were done to find out proportions of the materials. The decision to do bobbin lace of conductive and not conductive yarn was done. Sensor and heating-display are
in one piece, so that it was decided to use contact-sensors. The conductive felt works well as a pressure sensor, but it would cause short-cuts to have sensor and display as one piece. Further material sketches followed. After framing the design, functional tests regarding sensor quality and heating properties were done.

4.4 Material- and Textile Methods
Knippling was studied to get an overview on possibilities in knippling. Since knippling is used in different sizes in the project, decisions for bindings had to be done: Brabantbotten for the bigger layer and lace of silver-thread with beads for the touch sensor in the head application(fig 24). To get an interesting outcome of the print pattern with thermo-chromic inks, I had to consider the states of the pattern regarding the heating-effect.(fig 25-27) Thermo-chromic pigments function like that: The pigment has a colour that is shown. If the temperature reaches to the reaction temperature, the pigment will turn to invisible. To get interesting colour-effects, thermo-chromic pigments are blended with custom pigments: if the thermo-chromic pigment is turning to invisible, the other colour stays. That means, that the colour-range is limited, since staying colour can not be too dark, to make the colour-change of the thermo-chromic pigment visible. To get more variations in the visual colour-effect, dot-grids in fading size were used as halftone-prints. Combining them in different angles, pattern with an appearance that is corresponding the lace were the outcome. Several tests on the colour-effect were done, with the focus on monochrome shade turning to a contrast of warm-cold colours. The size of the pattern and its intensity has a variety on different parts of the material. The used parts were chosen by corresponding size of object and pattern. For the application of the circuit, soutage-emboridery was used, to make it possible to remove the silver-thread easily from the wool for recycling.

4.5 Interaction Methods
Bodymovements while common actions were observed and analysed(fig 28-33). The placement and kind of sensor had to be decided. It had to be considered, how the sensors could work and how the movements should be differed by the system. The concept for the „right“ movements and how to learn them has to be planed.

4.6 BREAK!-Reflection
The prelininary results(fig 34-37) were ready. And not satisfying. They did not look insecty. The lace disappeared as a material next to the felt and the wanted appearance was lost. Referring to the panopticon, the display was not necessary. Wearing the sensors would make aware that the system is there, that is enough and a subtle manipulation. Lace should be in the foreground. The number of materials should be reduced. The sensor on the head would not work unisex.
The insectiness has to subtle through the design and the sensors should have an exclusive delicate look. To become clear about the core and to be able to take decisions quickly, early marker sketches were taken to work from. A moodboard (fig 38) with keywords working people in suit, insectiness in design and jewellery was done. Collages (fig 39-41) and sketches (fig 42) followed, prototypes were tested on the body regarding function, placing and size.
4.6 Timing
To set the concept-base from the beginning, before starting with the physical work, was a good way to keep the timing later: by defining things from the beginning, bis concept-decisions were already taken. The knippling was a challenge, but was possible to learn until a certain grade by will. To give a limited time for every method helped to structure work, to not get lost in a detail. Important was, to work constantly from beginning, to avoid panic if things would not work out in the first try. Early in the work, the possibly problematic points such as technical problems, material-delivery time, were listed already in the beginning, to solve their organisation early, and to have a buffer of time for unexpected happenings. It was also tried to keep facts and artistic considerations causal and followable to be able to reflect on the parts and in the end the whole design process.
fig 42 Sketches
Final Process of the Arm-Sensor

- Torchon Ground with 2 twists
- Bucks Point Ground
- „Brabant“ Stitch

figures 43 steps of final process
Torchon Ground with 2 twists

Final Process of the Shoulder-Sensor
Final Process of the Knee-Sensor

figures 45 Steps of Final Process
4.7 Reflecting on the Methods:
A fixed concept was decided from the beginning to avoid struggling with the content of the work later in the process. The first marker-sketches were brainstorming about materials and realisation, the pencil drawings to define a more detailed aim of appearance of the sensors. The colour studies are an important field for contemporary textile design, to use thermo-chromic inks controlled and to bring the use of them further. The structured and causal work supported the communication with supervisors and others. The structured process, with a setted concept helped to keep the timing. Most of the materials were already in place or has been used before, so that no problems with delivery were faced. The balance of function and and aesthetics was a challenge, since electronics had to be learned as well as the knippling. After the break, and the point when I had to go back to earlier steps, a *tabula rasa* in mind and working space was needed. Though it was another chance to get a good result, the moment of having been working towards a wrong direction had to be overwinded. The main problem was, to come back to find a way to trust my own intuition and decisions again. After that point, I had to work time efficient. That means, I had to chose the right method for the next steps: how many material-experiments had to be done before making a new collage, which material choice is realistic for the time-frame etc. The opening of the exhibition and the exam-presentation was nearly the same date, which was good for focussing on a good way of presentation; having one final goal in mind was a good motivation and supportive for the work.
fig 47 Employee with Sensors
fig 48 Employee with Sensors
Your Balance is an interactive, textile jewelry with the inspiration taken from insects. It is a critical design project that deals with the control through the 24/7 availability and the expectation of efficient time-use we live with today. It questions our passive acceptance of applications of control in our daily life and ask what we want textile user interfaces to be. The three textile sensors monitor the movements of the employer to a system, watched by the employer to control the employee’s life balance(fig 52). Communication between employer and employee becomes closer, the amount of work and responsibilities can be adjusted according to the data and long-term efficiency is provided.

Are we like worker-bees, working efficiently towards the center of the hive?

The Balance-Curve shows the movement of the three sensors. Graph one and three shows how often the sensor (knee and shoulder) gives a signal. Graph two shows the pace and smoothness of the movement of the arm. Anytime can be controlled, if the wearer has a balanced lifestyle.
6 Reflection

Coming from industrial design, which is mainly in service of production and commercialism, I have an ambiguous position towards how I want to use my design knowledge. Thinking about utility and several concepts of how design can influence the society, I was very interested in interface design, especially in tangible interfaces. But I also watch people. I see people in public transportation being occupied with their mobile devices, most of them using mass-communication and entertaining functions, social networks nearly every free minute. They are very occupied and don’t communicate with people in the real environment.

I am a person who likes places in nature where no sound of civilisation is around. I like to get the weather straight in my face.

Deciding my thesis project, I thought about the diverse aspects in what I like about nature and what I like about technique. I really wanted to find out, how our perception changes regarding how it is challenged by materials and interaction. By utility?

I always have had a close relation to textiles and materials, close because I like to experience them, a rough sisal mat, a soft silk surface, and also the sound and hand of them.

Why I like nature is because I think in nature we have to accept our size as a single person. Interacting with nature happenings is necessary to survive, for example being by the sea, one has to react to the waves and weather. If one is able to accept things that happen in nature, in a bigger context that we cannot rule, details can be seen in a different way. If one does not think that the uncontrollability of the weather is the problem, he can focus on preparing the roof for the next storm.

Flowing with the processes let a person live in the here and now. Efficiency in nature has to do with pace and the actual necessity and becomes experience-able.

I think in the last century, individualism became too important. The development of technique to small mobile objects that each person has on his own has changed the relation of us as a single person to the world. We have a fake individualism by having our own devices. We think we show our individuality by posting our actual status to the world or telling everybody in the radio what we are doing. Many of those actions happen because people think they have to show up to be somebody. Realizing that this is a force of society of control and in the end the system of efficiency happens not often.

With new devices we put ourselves in systems of surveillance and prestige. Values that have been divided in professional and private life have become one. Organizing friends has become a case of efficient management and marketing.
With the distance that we keep to each other through non-face-to-face communication, we don’t have many real-time memories, in which we were focussed on each other. We consume other people to avoid to be bored and to keep a „good“, or „cool“ image of ourselves.

This pulsing works as the rhythm of machines, of a functioning production. That is a conflict to the open processes of nature.
By that, my thesis touches the critic that has been in times of industrialisation: of human becoming machines. A change in the fact of keeping the machine-pulsing away from us has not happened. Or, to talk politics, the society is divided in observers and observed. The use is in the productivity of the society, which is an economic interest. The thought of the humanism of the renaissance, to provide a society of emancipated human beings has disappeared.

In different to other works mentioned in this thesis, I use a new material in the contemporary context. Those materials are still in development, I discuss them already in an early state, seeing their positive and negative aspects.

Regarding the new materials, I think researching and experimenting is interesting, challenging and gives positive experiences to the scientist. I think it is very important, that the researcher is not switching his sanity off. Creating in the service of science is also in the interest of a consumption system. The personal responsibility to think in the human way about the effect of a development to the society should not be forgotten.

In my thesis, I showed one role, textile user interfaces could take. I think using the methods and tools of design to motivate people to reflect is a contemporary way of design, so I think critical design as a method was the right choice to show the ambivalence in which I as a designer am working. The break and reflection on earlier stages of the process was very important for me. The aesthetics that I wanted to achieve from the beginning were found again. With those, the whole concept works out.
For myself, I have to find a way to live on being a designer but choosing the work I can stand for. This is what I have to develop for myself. I am curious to see which role design will take in the future and I am happy to be a part of that development.
Thanks a lot for a challenging and nice time at THS and especially for support and patience in the final semester:

Andreas Peiffer; Anne-Britt Torskildsby; Esther Stühmer; Hanna Landin; Hira Shah; Jan Berg; Joel Prehn; Karin Schneider; Kristian Rödby; Lars Brandin; Lars Hallnäs; Linda Worbin; Lotta Jylli; Maiko Tanaka; Mama; Margaretha Zetterblom; Marie Dreiman; Michael Gülzow; Mika Satomi; Mili Tharakhan; Nan Kitchinee; Papa; Sonja Jocic; Stig Abrahamsson; Susanna Lidén; Susanne Edström; Tatjana Kroupinina; Tina Ahlström; Tommy Martinsson; Ulrika Elovsson; Una Baldvinsdottir; Yi Xing Xi; Zizi Zhu
Literature

A Comprehensive Etymological Dictionary of English Language Klein E., Elsevier, Amsterdam, 1966
IT+Textiles Redström, M, Redström, Mazé R, Helsinki 2005
Zeit ist mehr als Geld with Prof. Barbara Adam, Cardiff, Wales, Leitner B dradio Berlin 2010
IDEO Human Centered Design Kit IDEO, 2009
Human-Computer Interaction in the New Millenium John M. Carroll, ed.; © Addison-Wesley, August 2001
Designing the World as Your Palette Ryokai, K., Marti, S., Ishii, H. 2005
Discipline & Punish: The Birth of the Prison Foucault, Michel NY 1995 pp. 195-228
Memphis Fitoussi, B London 1998
Hertzian Tales Dunne, A MIT Press 1999
Textile Futures Quinn, B 2010

Figures

1 www.reactable.com 13/04/2012
2 Designing the World as Your Palette Ryokai, K., Marti, S., Ishii, H. 2005
3 www.cutecircuit.com 13/04/2012
4-10 Barbro Scholz 2012 (Private Collection)
11 www.wikipedia.de 13/04/2012
12 www.damienosullivan.com 13/04/2012
13 www.dunneandraby.co.uk 13/04/2012
14 www.studiomakkinkbey.nl/ 13/04/2010
15-45 Barbro Scholz 2012 (Private Collection)
46-51 photographer Jan Berg 2012 (Private Collection Barbro Scholz)

Websites

http://www.miljögiraff.se, 13/04/2012
http://www.studiomakkinkbey.nl/ 13/04/2012
http://www.ideo.com 13/04/2012

Thesis Number : 2012.8.1