Inaugural lecture
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Matter of transformation
Sculpting a valuable tomorrow
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Technological mediation

Today, I would like to take you on a journey into tomorrow. Will you appreciate the tomorrow that I sketch? That is for you to decide. Will the vision that I sketch become reality? Time will tell; I’m not a fortune-teller and the world is a dynamic place. What is certain, however, is that we can influence ‘tomorrow’, as we can envision it. Especially when I look at the youngsters of today: my kids, but also our students; a whole new generation looking with fresh eyes to what their role can be in society. What kind of society and values do we want to pass on to them?

Turn on the TV, open up a newspaper or browse the web and we see major societal challenges, including pollution, global warming, wealth disparity, limited natural resources, safety and health issues, and more. All severe issues that call for societal transformation. Which makes me appreciate all the more the active position Eindhoven University of Technology has taken by putting “science for society” so prominently on its agenda. The consequence of doing science for society immediately brings us back to the same question: What kind of society do we envision and want to support through science? We have to take an ethical stance. Or as Peter-Paul Verbeek (2006) says “engineers are doing ‘ethics by other means’: they materialize morality”. With his concept of Technological Mediation, which builds on work of Don Ihde (1990) and Bruno Latour (1992, 1994), among others, he shows that technologies are not neutral but are a medium between humans and reality and they co-shape people’s being in the world. Technologies transform our perception by amplifying specific aspects of reality while reducing others through mediating between our senses and reality. Moreover, technologies translate our actions by inviting specific actions while inhibiting others. And depending on the context and situation, technologies are multi-stable, meaning that they can have different interpretations, intentions and identities. For example, the telephone was originally developed to help the hard of hearing, yet turned into a communication device for all. Now, with the current network, a smart phone makes it possible to maintain social relationships at long distance, but can also give the feeling that one should be always available.

So, what is the valuable tomorrow we want to sculpt using technologies?
Making sense of the world

Although I am not a philosopher, I still like to briefly turn towards philosophy, since it is intertwined with design and influences our tomorrow. The concept that helps us to get grip on how we make sense of the world or the way we give meaning to our lives is essential for sculpting a valuable tomorrow, since this process of making determines what we consider valuable.

As I said, I will only address this briefly, but if you would like a more elaborate picture, I would advise you to watch the captivating movie “Being in the world” by Tao Ruspoli, in which the philosophical stance that I endorse is beautifully explained in word and action. You can also engage directly with the original philosophical and scientific writings. Although this demands more effort, it can be extremely gratifying, depending on your interest and expertise.

Throughout thousands of years of history Western philosophers have contemplated the most important aspect of man, something that makes us unique, which is that we can think; we are rational, intellectual beings. In the 17th century, Rene Descartes (1637), extended this concept by stating that we are a ‘thinking thing’ with a mind, and that in our minds we have ideas, we have experience and we have a representation of the world. According to Descartes, knowledge is made of ‘mind-stuff’ which is disengaged from the body and from the physical world of objects: a subject-object, or mind-body division (Dreyfus et al., 2010). I will explain later what this means for our Western way of thinking and living.

In the 20th century, philosophers, and more specifically, phenomenologists like Martin Heidegger (1927) and Maurice Merleau-Ponty (1962) and pragmatists like John Dewey (1934), turned the Cartesian Western worldview inside out. Merleau-Ponty considered ‘embodiment’ and ‘skilful coping’ to be unique characteristics of man; that is, we are able to engage with the world and develop skills while acting in the world. There is no divide between subject and object: “The meaning of things ... exist[s] neither ‘inside’ our minds nor in the world itself, but in the space between us and the world, in the interaction” (Matthews, 2006, p.33). We perceive
the world in terms of what we can do with it, and by physically interacting with it we access and express this meaning. Meaning is created in interaction. To cope skilfully in the world from day to day, we do not need a mental representation of our goals; our body is simply solicited by the situation to find the right balance so as to gain a maximum grip on the situation (Merleau-Ponty, 1962; Dreyfus 1996).

These notions of embodiment and skilful coping did not only arise in philosophy, but also in other fields like psychology, anthropology, pedagogy and biology, across different cultures. James Gibson (1979), with his ecological theory of perception, introduced the concepts of affordances and effectivities to show that the characteristics of the human world (e.g. what affords walking on, squeezing through, reaching, etc.) correlate with our bodily capacities and acquired skills, that is our effectivities (Dreyfus, 1996). For example, a skateboarder can perceive a surface or object as jumpable, if he has the proper body, skills, speed and courage.

According to Merleau-Ponty (1962), the concept of embodiment, that is core in phenomenology, includes three ways the body opens up to the world; three ways why the ridge is jumpable for that skateboarder. Firstly, the world opens up through the actual shape and innate capacities of the human body; the ridge is jumpable because the skateboarder has legs that can bend and stretch to generate the power to jump, and he has two feet that give him stability on the skateboard. Secondly, we have skills for coping with the world, and as we refine these skills, e.g. by practising jumping with the skateboard, things show up as soliciting our skilful responses, so that as we refine our skills, we encounter more and more differentiated solicitations to act. Thus, while improving his skills of jumping, the skateboarder perceives his environment differently and sees more and more possibilities for jumping. Thirdly, and lastly, the cultural world has a relationship with our body. Only because we Western Europeans are brought up with skateboards in concrete cities where it is OK to jump on benches, specific ridges solicit the skateboarder to jump on them (Dreyfus, 1996). So, meaning is created in interaction by the skateboarder who is trying to get a maximum grip on that specific situation.
Transform through embodiment

So, what are the implications of these worldviews for our lives? How does technology enable us to make sense of the world around us, and what gives meaning to our lives? What kind of tomorrow do we want to sculpt together?

When we look at our current society, our technologies and the designed world, you can see that the Cartesian worldview is still dominant; we value our minds highly. There are many technologies in the world exploiting cognition and downplaying the body. Making our lives easy by saving labour or physical actions. Giving us choice by pushing the right button. Turning reality into information that we can access always and everywhere. We seem to like making things efficient, optimising solutions. We seem to work towards standardisation, with the increasing possibility nowadays to supplement this standardisation through (digital) personalisation. Through all of this we are aiming for progress.

Technology gives us many advantages. I personally live in a comfortable house, I can buy all the food that I like, I can travel virtually everywhere and I can be online 24/7. My mother can live independently at home, with a support system in case anything goes wrong. We extend and save lives with our technologies. But despite all these advantages, why are we still facing such major societal challenges?

Can we explore alternative ways to engage with the world? One in which we use all our skills to open up to new possibilities and disclose new worlds? One in which technology invites us to find and show ourselves through our skills? Can we create a world where we take the risk to fail in order to learn and create freedom to discover? Can we create a world where we trust our senses? Where intuition is at least as valuable as rationality? Where commitment and engagement are valuable assets for growth? Where we take a first person perspective and are immersed in the moment, instead of being disengaged and going for this abstract notion of efficiency?

How do we have the patience to go for quality and to develop and master skills? How can we value craftsmanship, i.e. simply having the desire to do a job well for
its own sake (Sennett, 2008)? How can we embrace ambiguity, resistance, complexity and open-endedness?

I see a tomorrow in which we can face our societal challenges by using technology to embrace embodiment and throwing ourselves in. By exploring a paradigm shift through innovation, to really make the difference. I believe that our complex societal challenges require solutions that support us to change our behaviour on a personal and societal level. Developing technologies that enable transformation by starting from a different set of values based on embodiment, that open up the world.

How can people access sensitivity and quality?

Look at Fluenci, developed by Master graduate Jaap Knoester, a breast-pump that draws from the experience of breastfeeding a baby at home and sets its behaviour as naturally as possible in order to reduce stress and discomfort. The shape and temperature invite a more intimate way of holding, recorded baby sounds trigger the milk lactation and the pump starts, stops and adjusts its speed in a natural way. The transformation comes through the shift from seeing relaxation as a requirement for optimal milk lactation, to seeing relaxation as values for obtaining wellbeing and resonance with the world.

Look at LinguaBytes, developed by Bart Hengeveld (2011) for his doctoral research, which is a tangible, language learning system for toddlers with no or little verbal communication; it respects the highly diverse skills, needs, wishes and desires of these children. A transformation comes through the shift from making digital learning tools as a means to learn to know, to making embodied learning tools as a means to learn to act and communicate in the world and develop as a person.
Or look at Rights through Making, the doctoral research of Ambra Trotto (2011). Can the power of making, conjugated with local design culture, pave the way for a new way of thinking? Can we design products and systems that entice people to reach the ideals contained in the Universal Declaration of Human Rights? For example, getting power to recharge your mobile phone through a hug. A transformation comes through the shift from seeing technology as a means for efficiency, to seeing technology as a means for engagement and respect.

How can we sculpt this valuable tomorrow together? Phenomenological design brings an alternative way to engage with the world.
Phenomenological design

So what does an approach to phenomenological design entail? I will address five implications, related to the way of working and to the results of design activities. I elucidate these implications through examples from our capacity group and our students, since this approach is not my individual quest. It is based on well over twenty-five years of design research and education, which started with Gerda Smets, Kees Overbeeke and Pieter Jan Stappers within the Form Theory group at Delft University of Technology, whom I joined in 1993. And for years now it has been the quest of the Designing Quality of Interaction group at Eindhoven University of Technology, which I have been proudly leading since last year. Many of the examples described in this lecture can be viewed at http://dqi.id.tue.nl/web/work/systems-design-the-eindhoven-school/

Does the fact that I focus on phenomenological design mean that the approach and implications I address today are only interesting or usable for designers? I hope not; they can also be seen as a way of approaching life. Moreover, designing is multi-disciplinary and with the current complexity of our societal challenges, we need the whole spectrum of experts and citizens to sculpt that valuable tomorrow. That is also why we draw our inspiration and theoretical foundation from various disciplines. Additionally, the trust that I got well over a year ago to lead the interdepartmental theme of Smart Environment within the Strategic Area Health@TU/e, stimulated me to explore how we can connect and work together and what phenomenology can mean for health care, which I also address in this lecture.

In the remainder of this lecture, I address the implications our phenomenological stance has on:
1. the act of designing
2. the designed systems, products and services
3. the way of collaborating
4. supporting methods, processes, techniques and tools
5. the way of doing design research and education
1. The act of designing
The call to open up to ‘radical’ new skills and meaning to enable societal transformation and realise behavioural change on a societal level is getting stronger every day. Designing is perfectly suited to play an active role in this shift towards societal transformation, since designing is about localising (making a matter concrete), questioning (reflection on its quality) and opening up (expanding its sense) (Sennett, 2008).

So what is designing and which of its characteristics are important? In the perspective of our philosophical stance, designing can be seen as the act of creating opportunities for meaning to arise in interaction in a specific socio-cultural context. Designing is not about problem solving, as is often thought, implying that the solution space is already determined by the problem definition, but it is about opening up, exploring new territories, reframing and imagining things that do not yet exist. Designing is not about wanting to organise and control the situation and problem from the start, but is about surfing the waves of complexity, uncertainty, open-endedness and resistance, and about finding new worlds by engaging in the situation. According to Nelson and Stolterman (2003) designing is about creating desirable and appropriate compositions and not about creating true solutions, or finding the truth. It is a combination of action and inquiry. This designer attitude is a quality that is appealing more and more to other disciplines. Boland and Collopy (2004), for example, advocate that managers should adopt a design attitude, and realise that they (the managers) are not merely decision makers.

This emergence of meaning occurs during human-product interaction, as well during the act of designing itself. I will explain why this, in fact, means that making is quintessential. Firstly, by building and offering a variety of experienceable prototypes through quick iterations, designers enable people to have access to and express meaning in their everyday context, which informs the designers about the direction to go. This would be difficult to do with abstract ideas alone, since these cannot be experienced or interacted with (perhaps only imaginatively). Secondly, making enables designers to explore the unknown by trusting their senses, exploring expressivity and tapping into their intuition. Intuition is usually not considered as an ‘official’ modus operandi within the scientific world, because using intuition does not contribute to enabling the process to be repeated by others. Yet because of the complexity of design processes and the intrinsic complexity of people – intuition is an indispensable component in design – it is the
tool that empowers us to make choices in the iterations of a design process (Overbeeke and Hummels, to be published). Dijksterhuis and Nordgren (2006) show that intuition, or unaware thought, is better suited for dealing with complex matters than conscious thought. And there is no lack of complexity in design (Anderson & Krathwohl, 2001).

But designing is more than an intuitive act. It opens up the abstract to the sensorial. It connects the intuitive to the analytical, imagination to reason, and making (synthesise and concretise) to thinking (analyse and abstract). Designing creates insight and knowledge through the mechanism of reflection in and on action (Dewey, 1938; Schön, 1983). Or, as Schön (1983) suggests, by entering into an experience, without judgment, responding to surprises through reflection, we learn from our actions.

Finally, I would like to address one more consequence of a phenomenological approach to designing, namely the point of view. Merleau-Ponty (1962) showed that we do not perceive ourselves as one more object in the world; we perceive ourselves as the point of view from which we perceive objects in the world (Trotto et al., 2012). Consequently, for us designing is rooted in a first-person perspective while intermittently taking a third-person perspective. Throughout our years of educating we have seen that even designers tend to remain in the cloud of abstraction (third-person perspective), without deliberately putting themselves - their point of view, their experience, their skills - into the design space (first-person perspective). Especially when working in teams, these hidden first-person perspectives (since there always is a first-person perspective but often not explicitly on the table) will get in the way if the student attempts to restrict himself or herself to an objective God’s eye view. Fat chance that the team members will not agree on this third-person perspective, so better have it out in the open (Dijk van, to be published). By taking a first-person perspective, designers are a part of their designs; they bring in their own value system and skills and are not objective, which is again not an ‘official’ modus operandi within the scientific world.

2. The designed systems, products and services
So how does this approach to designing influence the outcome of the design process? How can we use technology in a way that it uses embodiment? Although it is challenging for designers that electronic circuits and microprocessors have broken the intrinsic link between functionality, appearance and actions (bits and
bytes don't offer a mechanistic structure like a bolt or a cogwheel), it also gives us the freedom to create what we envision and prefer. Miniaturisation, networked technology, Wi-Fi, unlimited processing power, smart materials ... they give us plenty of opportunities to sculpt a valuable tomorrow, but how?

Taking phenomenology and embodiment as a starting point for designing systems, products and services tunes human-product interaction towards behaviour and action instead of cognition and language. Djajadingingrat et al. (2004) call this taking on the direct rather than the semantic approach.

An example of this direct approach is Augmented Speed-Skate Experience (ASE) by Jelle Stienstra (Stienstra et al., 2012). This design enables professional speed skaters to assess and improve their technique by translating the movement, pressure and balance of their skates onto the ice into auditory feedback. The amount of pressure is translated into the amount of sound, loudness, coupling the left speed skate to the left ear and the right speed skate to the right ear. The balance between leaning on the front or back of a speed skate is coupled to pitch, i.e. gradually shifting from front to back will result in a gradual shift from a high to a low pitch. Every skater creates his or her own meaning of this sonification in action.

As already mentioned, the Cartesian perspective is dominant in interacting with our technological appliances. We see many technologies and machines that rely mainly on cognition and efficiency, including vending machines. “Simply type in a code” and get your drink (and try to ignore the often troublesome way of picking up your purchase and change). Friendly Vending, developed by Guus Baggermans, offers an alternative way of interaction, based on embodiment and direct manipulation. The friendly vending machine tracks the movements of the consumer and responds accordingly. It offers the goods at the point of interaction.
Friendly vending is about usability, coming from embodiment, and opening up to sensory richness, expressiveness and aesthetics of interaction. It invites users to engage in aesthetically rewarding experiences and find value including usability and functionality. It is easy, not in the sense of efficient but in fitting what you do, and in combination with richness it makes the experience more rewarding and can even result in a feeling of resonance, being perfectly in sync with a product (Hummels, 2007).

By moving towards embodiment and aesthetics of interaction, people are supported to use, stay attuned to and develop their bodily skills. And since meaning is created in interaction, aesthetics and value are not absolute things, but person- and context-dependent. Our current seeming preference for making the interaction with products efficient, optimized and numerical is often at odds with this quest for beauty, expressiveness and resonance, which demands diversity, subtlety, richness and, at times, imperfection.

Considering my role within the interdepartmental Smart Environment (SE) theme, let us turn briefly to designing for health and wellbeing. Today I will not address the mission and vision of SE, which can be read in the white paper of Smart Environment (Hummels, 2012). I will focus on the potential of phenomenology for health and wellbeing.

Similar to most of our technologies, the health care system with its related technologies is strongly positioned within a Cartesian tradition. We like to analyse, know and trust our minds to determine our health and wellbeing status. There are thousands of health appliances, apps and websites available that enable us to monitor and analyse our health status. The adage seems to be “the numbers don’t lie”, or in Dutch “meten is weten”. We like to move towards self-management to get control and reduce costs. We like to make things efficient and standardised to create an optimal health care system. For example, there are standardised procedures for dealing with diabetes, obesity or smoking habits. Even a personalised development like the Individual Care Plan is based on strict classifications (including codes for e.g. diseases, treatment and medication) and does not look at a specific individual in a specific situation at a specific point in his or her life.

We like to improve health care management by using performance indicators to increase efficiency and quality, and reduce costs. We like to have evidence based
(acute) care validated through double-blind randomised studies, thus providing control and increasing (apparent) quality.

Despite the advantages of these types of measuring and management, what seems liberating at first sight can easily backfire and become a procedural straightjacket. “Performance indicators can lead to perverse behaviour. ... create a paper reality. ... The measuring and recording madness extends naturally: there must be more and more measured and administered by more and more people on more and more activities.” (Trappenburg, 2008).

Can measuring lead to behavioural changes and societal transformation in the long run? I don't know. But I do know that the first coin-operated weighing scales were already available in the late nineteenth century and we now have Wi-Fi versions that perform dozens of measurements. Yet all this extra information does not seem to influence our eating habits or movement patterns in a positive way to maintain a healthy weight; the percentage of overweight people in the Netherlands has increased from 27% to 41% over the last thirty years (CBS, 2012).

We might need additional strategies towards personal, social and societal health and wellbeing that exploit our physical skills instead of leaning too much on cognitive skills to improve our health and wellbeing. Phenomenology can bring a different point of view by emphasising the first person perspective (individuals differ substantially in the ways they behave in relation to their health), the dynamic character of meaning (value changes over time) and the importance of embodiment (reconnect to our body and senses to experience and feel our fatigue, food saturation, stress and balance, etc.). Phenomenology can bring in the subjective experience of our own health in addition to the clinical description of our health status, thus tapping into intrinsic motivation towards behaviour change. Sjaak Bloem and Joost Stalpers (2012) identify three determinants that have an impact on the experience of health: perceived control (do you believe that you or someone else can influence or control your health?), acceptance (are your health condition and constraints acceptable and fitting for you?) and adjustment (are you successful in adapting behaviourally to the constraints?). Scoring differently on these three axes lead to different coping strategies and demand different support from experts and technology. Todres and Galvin (2010) relate the experience of wellbeing to a combination of dwelling and mobility, which can generate new perspectives for designing health care. Dwelling is related to having a sense of being at home and grounded in the
moment, a sense of belonging, peace, comfort and being at one with the world. Mobility is related to having a sense of adventure and being in flow; a sense of mysterious interpersonal attraction, excitement, desire and vitality; the feeling that “you can”.

Employing new technologies towards embodied interaction and aesthetics, related to concepts such as subjective health experience and dwelling mobility, can create valuable alternatives. For example, losing 15 kg of weight can be considered a vitality gain, but designing for vitality results in completely different products than designing for losing 15 kg. Let me cite a few examples to explain what phenomenological design can bring to health and wellbeing.

Bouncers, a design by Terence Nelson (2012), seems a first step away from hard numbers and graphs, and might be interesting for people with a high level of acceptance and perceived control. This wallpaper on the smart phones of a group of friends visualises everyone’s activity through gently moving circles to give an impression of everyone's physical activity. It is not about the exact activity, the number of steps or the heart rate but about getting a feeling of your body and movements in relation to your friends, and creating a bond between them through this information.

When designing such networked products with a ‘softer’ approach to data, we do touch upon ‘hard’ issues like data management and software architecture. Who owns the information? Which information should be presented what way? How open or closed is the system?

The Affective Pen by Miguel Bruns (2010) focuses on stress reduction: evoking a feeling of peace and comfort via embodiment instead via the mind. Instead of
focusing on a cognitive interpretation of one’s stress level through displaying sensor data, his stress-awareness pen can track the stress of its user through the movement of a small ball in the top of the pen (stress generally increases fiddling), and it can also manipulate the movement of the same ball to make the user physically aware of an increase or decrease in stress. As it turns out, it influences the behaviour (reduced heart rate variability) without the user even knowing (the questionnaire did not show a difference in stress perception).

Evoking feelings of dwelling and mobility requires expressivity, subtlety and sensitivity. Be Touched (see http://dqi.id.tue.nl/sensual-dynamics), designed by Josje Wijnen, Jurrian Tjeenk Willink, Kim van Iersel and Sebastiaan Pijnappel was developed for scientific reasons, to gain more insight into the reciprocal interplay between the perceiver and the perceived, the topic of Eva Deckers’ doctoral research (Deckers, to be published). However, these phenomenological concepts and these sensual dynamic subtleties (Levy et al., 2012) have great potential for designing for wellbeing. The expression of Be Touched can be linked, for example, to feelings of dwelling like kinship, belonging and ‘being at one with’ the world.

3. The way of collaborating
Since the complexity of designing (intelligent) systems, products and services has increased rapidly the last decade, the need for collaboration among all the cross-disciplinary stakeholders is becoming paramount. These stakeholders, experts in their own field, may come from academia, governmental bodies, (non-)profit organisations and societal bodies as well as from industrial partners. Moreover, the close involvement of citizens (or clients, users or consumers, depending on
the frame of reference one takes) who will interact with the ‘end’ products is necessary.

Reon Brand and Simona Rocchi (2011) see this kind of collaboration at the core of a new emerging economy, i.e. the transformation economy. Brand and Rocchi discern four different paradigms from the 1950s onwards: the industrial, the experience, the knowledge and the transformation economy, which I will address briefly.

From industrial economy to experience economy
From the turn of the 20th century, societies in advanced industrial economies developed a shared aspiration to modernize their lives, which gave rise to the Industrial Economy after the Second World War. Most of the economic value was delivered through cycles of industrial production and mass product consumption. The company offered the consumer a commodity which aimed at fulfilling functional needs. The collaboration between company and consumer was one-directional, top-down and captured in clear procedures, as was the relationship with consumers in other domains like government and university.

As products became more and more similar from a functional perspective and product quality became a commodity, companies found themselves increasingly susceptible to cheap competition. This led companies to seek other ways to differentiate their products by offering lifestyle options and brand experiences. Although the company was still determining the whole process, the moments of
contact between company and consumer intensified through various media channels. This was again the case in other domains.

The knowledge economy
With the advent of networked computers, wireless information superhighways, miniaturised technology and Web 2.0, people no longer needed brands and subcultures to shape their lifestyles, instead turning to online communities 24/7. In our current contemporary paradigm the world revolves around knowledge and information, which comes in different forms, e.g. shared information and reviews from users on Internet, sensor data from networked appliances, and knowledge from experts. The shift from passive consumers to ‘users-as-producers’ requires a way of collaboration between the different experts and consumers that is different than before (Gardien et al., submitted), which can be challenging for organisations, especially for institutes and communities that have had a God’s eye view up till now like universities, government and the medical world.

The transformation economy
Brand and Rocchi (2011) already foresee the next paradigm building on top of the others. Our major societal challenges are leading to a growing discomfort and quest for balance. Therefore, people are looking for ways, products and services that help us to move towards a sustainable world. True sustainability and wellbeing cannot be created on an individual level only, as is the case in the knowledge paradigm. It requires behavioural change on a societal level too, where the collective is more important than the individual. These trends will move our society towards the transformation paradigm in the future, where stakeholders work together on local solutions for local issues that stem from greater global issues (Gardien et al., submitted).

In my opinion, the collaboration within the transformation economy requires engagement and empathy, respect based on a horizontal collaboration in which all stakeholders are equal, but not identical, and valuable in their own way. It asks people to put themselves - their point of view, their value system, their experience and their skills - into the shared design space. Such a transformation economy requires new ways of organising and working together, new business and financial models and new legal constructions.

Through fostering continued relationships with local partners over time, organisations become respected players in these value networks. Living Labs
Global and Smarter Living 2020 are the first examples of such networks in the Health domain and ones in which TU/e participates. Within the context of the Dutch Creative Industry Scientific Programme (CRISP 2011), Oscar Tomico, Martijn ten Bhömer and Kristi Kuusk are developing a value co-creation platform that supports the development of innovative Product Service Systems (PSS) in the context of smart textile services. In order to face the complexity of PSS, this platform aims to facilitate close collaboration between small and medium enterprises from Dutch textile and technology industry, service partners, creative hubs and universities (Bhömer, ten et al., 2012).

Collaboration is also the key issue of OOHOO, a company concept developed by our ID graduate students Mark Thielen, Idowe Ayoola, Rik van Donselaar and Roland Coops. OOHOO connects experienced skilful older citizens to young designers to develop tangible propositions to face our social challenges sponsored by companies. This way they aim to create new societal systems in which all generations are valued and needed.

4. Supporting methods, processes, techniques and tools
Phenomenological design within a transformation economy requires new kinds of support; methods, processes, techniques and tools that support embodiment and open up to one’s skills, that enable the sensorial/intuitive to connect the abstract/analytical, that stimulates making next to thinking, that facilitates reflection in and on action, and that promotes trans-disciplinary collaboration in everyday life. I will briefly explain a few examples of this new kind of support.
**RTDP**

The Reflective Transformative Design Process (Hummels and Frens, 2009 & 2011) is a flexible and open design process developed for designing for societal transformation.

Developing design solutions placed in the centre of this model can be seen as a process of taking decisions based on too little information, but taken to the best of the designer’s and the community’s experience and knowledge at that point. The RTD process has two axes: vertical, where we distinguish two drives, and horizontal, where we distinguish two strategies for information gathering to direct design decisions. Designers can use two drives for information gathering: envisioning personal, social and societal transformation, and exploring and validating design decisions in an everyday context with users even beyond launching the system, product and services in the market. Additionally, designers can use two strategies to generate information to support these decisions, which reciprocally provide focus for each other: design making (synthesising and concretising) and design thinking (analysing and abstracting).

Depending on the person, context or phase within the design process, the designer determines where he or she starts, how often he or she swaps from one activity to another (although a high pace is recommended), and the order of activities (with a prominent role for making). With every jump to another activity
there is a natural moment for reflection, which can even be facilitated by software applications, like Freed developed by Philip Mendels (Mendels et al., 2011). Freed visualises in multiple views the relationships between digital content created during the design process.

**Connecting the sensorial/intuitive to the abstract/analytical**

Quickly switching between making and thinking, intuition and reason, senses and mind is often difficult within the design process. Therefore we developed methods and techniques to support design students to quickly make these connections. Most existing design processes start with an analysis of the situation and the design challenge from a third person perspective. We often start with making movies to explore the situation or one’s own skill or perspective, because we want the design students to trust their senses, and to feel and engage with the world.

Another entrance that we often use is Design Choreography. This technique was pioneered by Sietske Klooster (Klooster et al., 2005) to explore meaning in interaction by means of (bodily) movement. The technique makes participants aware of the rich meaning that lies in movement. For example, Sietske is currently using her approach to develop a new way of handling and valuing milk.
Thereupon, we ask the students to abstract the movies or their choreographies into interaction maps using different languages, e.g. words, graphics, bodily movements, like this example from Jeroen Blom, Chris Gruiters and Matthijs Jansen.

Finally, we move to interaction mechanisms and experienceable prototypes, and have them test their designs regularly to keep on switching from making to thinking (Hummels et al, 2009).

**Experiential Design Landscapes**

Since meaning is created in interaction, it is impossible to predict whether the resulting outcome of designing for radical innovation realises long-term societal change. Therefore, we take the design process into everyday life, involving a large group of stakeholders including citizens in their everyday environment, thus realising valuable propositions together. To do this we created Experiential Design Landscapes (EDL), infrastructures in neighbourhoods where all stakeholders work together, creating experienceable propositions with citizens, which evolve over time. These propositions, Experiential Probes (EP), are open, sensor-enhanced, networked products-service systems that enable citizens to develop new and emerging behaviour and, in parallel, enable detailed analysis of the emerging data patterns by researchers and designers as a source of inspiration for the development of future systems, products and services (Gent, van et al., 2011, Megens et al., submitted). This method is highly suitable to use within a transformation economy.

**5. The way of doing design research and education**

So, what do the previous four implications of phenomenological design mean for the way we conduct research and educate? Let me first address design research and conclude with our future: educating the new generation of design students.
As we have seen from all the examples, designers are typically operating in a constantly changing context that can never be accurately modelled (Wakkary, 2005), thus a reductionist approach to addressing this context and situations within would fail (Zimmerman, Forlizzi & Evenson, 2007). Consequently, design researchers have to embrace the richness of a complex design situation and act in a way that is appropriate for the specifics of that situation, using a Research-through-Design (RtD) approach. Often RtD is associated with Bruce Archer’s ‘research through practice’ (Archer, 1995), which can be seen as a process in which scientific knowledge is generated through a sequence of cycles of designing, building, and experimentally testing wealthy experiential prototypes in everyday life settings. This implicates that RtD aims at studying an effect in a possible future, instead of understanding the world, as is the objective of traditional science (Stappers, 2007). This approach will consequently result in conditional regularities instead of general laws (Hummels, 2000). The prototype is the physical, experiential manifestation of this; the carrier of integrated, contextualised knowledge, the physical manifestation of a design rationale. This means that when the test subject interacts with a prototype, he interacts with the designer-researcher’s line of thought. So, it can be beneficial if researcher and designer are one and the same person, as in the case of Bart Hengeveld (2011) during his own LinguaBytes project.

But design researchers can’t do it alone. As I said above, we need a broad spectrum of expertise to deal with the complexity of societal transformation. These means that the different scientific and engineering disciplines need to collaborate and learn from each other. When looking for example at cognitive sciences and industrial design, we see that both disciplines move towards embodiment (e.g. embodied cognition and phenomenological design), influencing each other’s perspectives of their own discipline. RtD produces knowledge that can generate questions for a cognitive scientist involved in this RtD process that would never surface through his or her own work. Likewise, by collaborating with cognitive scientists and thus acquiring knowledge from them about embodied cognition, for example, helps the design researcher to develop new physical hypotheses (Dijk, van, to be published). And by working together we can also increase mutual respect for the different ways of working and looking at the world.

I started this talk by looking at one of the main motivations for doing the work that I do: supporting this whole new generation of students to find their way in life, their passion, their skills, and to become excellent designers that help co-shape this world.
We are inspired by constructivism to offer this support to students. Similar to the body-mind relationships from phenomenology and the ecological approach to perception, there are learning theories, such as constructivism that focus on learner-world relationships. Common to this theory is the notion of activity: it is the learner who creates meaning, affected by and reflecting on his or her socio-cultural environment. It is about learning and performing through practical application, while simultaneously acquiring theoretical skills and building knowledge, where experience plays a crucial role (Dewey 1938). It is about continuous, life-long competency-centred learning, which is even enhanced by the current knowledge economy.

Constructivism requires a specific educational model with a transformative curriculum where teachers discard the God's-eye view, and emphasise and support a variety of positions, procedures and interpretations Doll (1986). Attitude is crucial in this approach. Within our continuous, life-long competency-centred learning model, our ID students develop the ability to learn from experience, to reflect, to self-regulate their learning, to take responsibility and to assess themselves. Members of staff need to make a shift from a teaching focus to a learning focus, and their role needs to change from being an authoritative source of knowledge to a facilitator of students' learning. Most importantly, they need to trust each other, take responsibility, tap into their intrinsic motivation, trust their intuition and dare to make mistakes (Hummels and Vinke, 2009). It is certainly not an easy approach, neither for students nor for staff, but it is a rewarding one resulting in a new type of designer that can have an active role in shaping a valuable tomorrow.

Having this active role in shaping a valuable tomorrow applies not only to students. I hope that by explaining a phenomenological stance towards designing for societal transformation, I have triggered you to think about alternative ways to deal with our societal challenges. But most preferably, I hope it invites you explore it yourself, by doing, together with us and others from different backgrounds and with different skills. Creating meaning in interaction; and applying technology in a way that entices the development of new skills towards a human world. As I have said, it's (a) matter of transformation. Let's sculpt that valuable tomorrow together.
Standing here today is only partly down to my merit; a considerate part is down to the credit of friends, family and colleagues. I like to thank you all from the bottom of my heart for your support, dedication, passion, patience, faith and friendship. Words can never capture my feeling of gratitude, nevertheless I would like to thank a few special persons in my life.

Let me start with two people that planted the academic seed and nurtured it in an exceptional and beautiful way. This would have been the moment to see the glint in his eyes and love in mine, but he is no longer here with us. Kees; professor Kees Overbeeke. You changed my life in so many ways; by getting me to Eindhoven, by pushing design in the academic world, by exploring interaction through classical music, by being a humanist at heart, by staying critical, by explaining the history of ancient worlds and by believing in us, next to so many other things. Grazie. And I would like to thank Gerda Smets for opening up the academic world to me and having functioned as a role model: a strong-headed female professor who went for excellence. Thank you for stimulating me to find my passion and go for the best.

When you look at DQI, you know that I have found the best; a beautiful group of passionate people who are inspired by their dreams and ideals, and who trust their own intuition and senses next to each other’s perspective, skills, experience, and critical minds. Joep, Oscar, Pierre, Miguel, Bart, Johanna, Anny, Rombout, Lucian, Philip, Eva, Michel, Martijn, Kristi, and both Jelles. Thank you for your trust and commitment to find our way after a tough year when Kees passed away last October. And this also applies to the bigger DQI community, Ambra, Remco, Carl, Lukas, Veronique, Patrizia, Philip, Stephan, Chet, Emile, John, Sietske and Stoffel. Thank you.

I would also like to thank our students and alumni; the trust that you put in yourselves and in us is heart-warming. I really admire you and hope that you keep on pushing the limits, sculpt that tomorrow and make us proud. Moreover, I want to thank all my friends and colleagues at Industrial Design. I believe we have the most beautiful school and education of the world, and I am proud to be working
with you all at ID. Jeu, thank you for getting me on board. Aarnout and Matthias thank you for opening up new worlds and stretching my boundaries. Sabine and Diana, although you both went to different parts of TU/e, you remain for me a part of ID and I thank you for your friendship, support and trust over the years. And I would also like to thank all my national and international colleagues, or better to say friends from the design world, many of whom came over for this day. My former colleagues and friends from Delft, especially Pieter Jan, Aadjan, Onno, Daan, Rob, Rudolf and David, and my international friends Bill Buxton, Lin-Lin Chen, Patrizia Marti, Mark Baskinger, John Zimmerman, Peter Krogh, Marianne Graves Petersen, Ilpo Koskinen, Toshi Yamanaka, Kuohsiang Chen, Chien-Hsu Chen, the TEI community and all others; thank you for your inspiration.

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Finally, I want to thank my family. My father Ben is no longer with us, but he would have been proud. But I'm pleased that I can thank my mother. Tini, thank you for pushing us to learn and develop our skills. And I thank my mother-in-law, Willie, always willing to step in and take care of the kids when I am away again. Gaby, Gerrit, Harry, Riny, Niek, Jos, Beatrice, Stijn en Franka: you don't select your brothers and sisters, especially when being the youngest, but I really appreciate you and our family.

Henny, Jonas, Pepijn, what would I be without you? Jonas en Pepijn, ik weet dat een werkende moeder niet altijd de gezelligste moeder is. Dank voor jullie onvoorwaardelijke liefde, zelfs als ik in de vakantie mijn intreerede zit te schrijven. Ik hou van jullie. Henny, my final words of gratitude and love are for you. And since I can't sing as beautifully as Mathilde Santing I will simple recite the lyrics.
I want her everywhere and if she’s beside me
I know I need never care
But to love her is to need her everywhere
Knowing that love is to share
Each one believing that love never dies
Watching her eyes and hoping I’m always there

(Here, there and everywhere, lyrics by the Beatles)

Ik heb gezegd.
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Caroline Hummels received her Master’s degree (cum laude) in Industrial Design Engineering at Delft University of Technology in 1993, after which she started working there as Assistant Professor in Form Theory and gained her PhD (cum laude) in 2000. In the summer of 2002 she was Visiting Researcher at Media Lab Europe, Dublin, Ireland. Two years later, in addition to her main job, she founded the design company ID-dock. In December 2006 she started working as Associate Professor at the department of Industrial Design at Eindhoven University of Technology. From 2008 till 2011 she was Director of Education at ID before becoming head of the Designing Quality in Interaction group, as well as Theme Leader for Smart Environment, Health@TU/e. Her activities concentrate on designing for transformation through aesthetic interaction with open, disruptive innovative systems.

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Prof.dr.ir. Caroline Hummels was appointed full-time professor of Design Theory of Intelligent Systems in the department of Industrial Design at Eindhoven University of Technology (TU/e) on September 15, 2011.
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