DESIGN UNITED

Platform for Dutch Research in Design

Colophon
DESIGN CHANGES
Design United,
Platform for Dutch Research in Design

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DESIGN UNITED

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Design Changes

Design Changes exhibition

The theme of the Design United Exhibition 2012 is 'Design Changes'. On the one hand, this theme refers to the potential contribution of Industrial Design to changes in our society related to diverse domains, such as sustainability, health and wellbeing. On the other hand, it refers to the fact that the discipline of Industrial Design itself is changing: more complex problems are being addressed, resulting in more extensive solutions that incorporate complete product and service system combinations.

The exhibition presents 11 cases of joint research projects, including ongoing and recently finished projects of the Industrial Design departments of Delft, Eindhoven and Twente, most of which involve industrial partners. The cases are divided across three themes: Health, Mobility and Work. They are explained through diverse media including interactive prototypes, posters and videos. The exhibition shows the diversity of design research conducted at the 3 universities, the collaboration with industry and other stakeholders, the research questions that are addressed, and the outcomes of the projects.

Inhoud

Design United

Design United, 'platform for Dutch Research in Design', is an initiative of the departments of Industrial Design of the three Technical Universities in the Netherlands. This initiative aims to increase the academic power of the field of Industrial Design and strengthen the innovative force of the Dutch industry. The yearly exhibition presents a number of projects in which Design United addresses the interaction between research and industry.

Industrial Design integrates knowledge from different disciplines and puts the user in a central position in the design process. It focuses both on the quality of the interface between user and product, and on the development of more complex systems incorporating multiple products and services. Within the context of increasingly complex societal issues, Industrial Designers have started to play a larger role in innovation processes. This requires knowledge, methodology, tools and new concepts concerning users, technology and business aspects.

By addressing social issues and involving industry in a diversity of projects, design research is better attuned to the needs of existing and future companies. Two-way communication between universities and industry will also strongly contribute to the opening-up of existing and new knowledge and methodologies.

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Health

Design changes HEALTH

Design can lead to innovations that improve peoples' health and wellbeing. Such innovations may impact different health contexts, including hospitals, care homes, shops and the home.

Trends

The costs for healthcare are rapidly increasing. Among the causes of this increase are the growth of the aging population and the increasing number of people with lifestyle-related diseases, such as obesity.
At the same time, less people are available to deliver care. These combined developments increase the strain on healthcare professionals.

Concrete examples, contexts

1. Design can create solutions that fit into people's lives, both in hospitals and at home.
   - Design can enhance communication and bonding between people, such as between parents and premature babies.
   - Design can create innovative services that bridge the care provided in the hospital and the home, extending the reach of the complete product service solution.
   - Design can transform the technology of a safe sensor solution into subtle opportunities for touch contact.
   - Design integrates knowledge from psychology, computer science and healthcare to improve the quality of precious phases of our lives.

2. At home design provides solutions to get children to be more active.
   - Interactive play environments that adjust their behavior to the players can keep children engaged and provide long-term fun and activity.
   - Combining knowledge about technology with knowledge about engaging experiences and healthy physical activity can lead to new play concepts that are appealing for people with different skills and interests.
   - Design can persuade people to adopt more healthy lifestyles.

Challenges

We need to learn more about how we can integrate technology in subtle user experiences. In addition, we need to explore how to apply existing knowledge to disease prevention and care solutions that fit into people's daily lives. In particular design research is needed to determine how theoretical knowledge about healthy behavior and choices can be integrated into products and services that contribute to healthy lifestyles.

Remote Comforting

Partners
Eindhoven University of Technology, Dept. Industrial Design; Máxima Medical Centre Veldhoven (MMC); Jewelco; ZonMw.

People
ir. Misha Croes, Eindhoven University of Technology, Dept. Industrial Design, PhD candidate; **prof.dr.ir. Loe Feijs,** Eindhoven University of Technology, Dept. Industrial Design, promoter; **prof.dr. Sidarto Bambang Oetomo,** Máxima Medical Centre Veldhoven, promoter.

FamilyArizing – support the bonding between parents and their prematurely born infant

Prematurely born infants usually have to spend the first period of their lives in a hospital incubator. This makes it difficult for parents to touch and comfort their babies. This project demonstrates an intelligent system that allows parents to provide a comforting touch even when they are away from the hospital.

A webcam mounted in the incubator registers when the baby experiences stress. It transmits a signal to a pendant worn by the parent, which starts to move. The parent can provide comfort by putting their hand on the pendant and inhibit the movement. This action is transmitted to the baby's mattress, which will softly contract, thus curbing the baby's motion.

A first prototype was used to convince stakeholders of the importance of the system. The present prototype will be employed to investigate the effects of the system on parents and their prematurely born infants.

External funding
Implementation grant by ZonMw.

Minimal invasive instruments

Partners
Delft University of Technology; Karl Storz GmbH; Catharina hospital Eindhoven.

People
ir. D. Vonck, Delft University of Technology, Dept. Industrial Design Engineering, PhD candidate; **prof.dr.ir. R.H.M. Goossens,** Delft University of Technology, Dept. Industrial Design Engineering and Erasmus Medical Center, promoter; **prof.ir. D.J. van Eijk,** Delft University of Technology, Dept. Industrial Design Engineering, promoter; **prof.dr. J.J. Jakimowicz,** Delft University of Technology, Dept. Industrial Design Engineering and Catharina hospital Eindhoven, co-promoter and medical advisor.

Laparoscopic surgery is abdominal surgery conducted through small incisions. This technique requires specially designed instruments to safely manipulate the soft organs. This is particularly true for the bowels since bowel damage is very dangerous. This project investigates the potential of vacuum technique as a manipulation and stabilization technique for laparoscopic surgery.

A laparoscopic vacuum grasper was developed and successfully tested by several expert surgeons. The tests showed that, even without extra training of surgeons, the instrument can be safely used on the bowel. The instrument is now scheduled for clinical trials.

A second instrument was developed for positioning and stabilizing the bowel. A first functional model was manufactured and tested successfully. A follow-up prototype is currently being manufactured for in-vivo tests. In conclusion, the project has shown that vacuum technique is a safe grasping technique to manipulate the bowels.

Hidden Health

Partners
University of Twente; Friesland Campina; University of Utrecht.

People
M.M. Gelici-Zeko, MSc, Dept. Engineering Technology, University of Twente, PhD candidate; **L.N. van der Laan,** MSc, Image Sciences Institute, University Medical Centre Utrecht, PhD candidate; **prof.dr.ir. R. ten Klooster,** Dept. Engineering Technology, University of Twente, promoter; **prof. dr. ir. Max A. Viergever,** Image Sciences Institute, University Medical Center Utrecht, promoter; **prof. dr. Denise T. D. de Ridder,** Dept. Clinical and Health Psychology, Utrecht University, promoter; **dr. Pascalle Weijzen,** Friesland Campina, project leader.

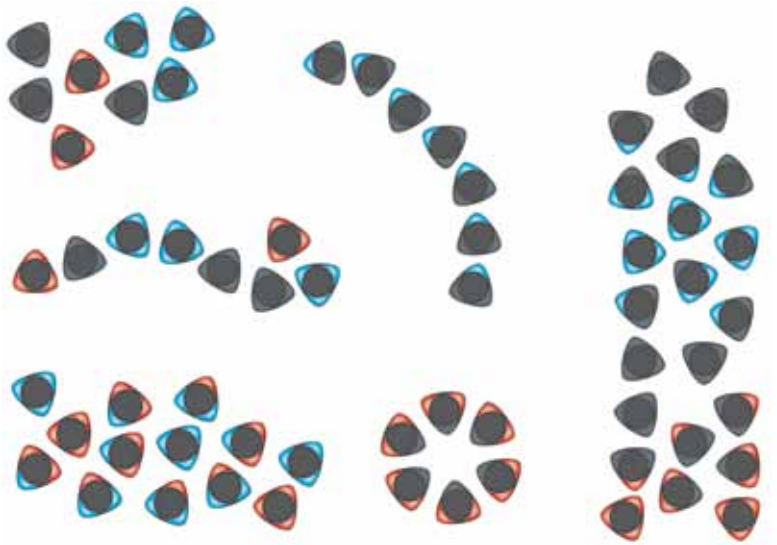
Understanding consumers' decision making

In the food industry, the struggle for competitive advantage is fierce. Food companies strive to regularly innovate food products and packaging. However, many new product/packaging combinations either fail or never even make it to the market.

'Hidden Health' aims to gain insight into how consumers choose food products. In a number of experiments, consumers looked at a number of dairy products displayed on a 'Virtual shelf' (a computer screen) and made their choices. By changing the design of the package, the influence of various package properties on consumers' choices was tested.

The results of the experiments are used to develop a toolbox that will help designers develop new food packaging. In addition, the toolbox, will facilitate the communication between the food marketeer and the package designer. Eventually, consumers may also benefit, as well-designed food packaging may help them choose healthier foods.

External financing
Friesland Campina



Seducing people to play

Partners
Eindhoven University of Technology, Dept. Industrial Design; Delft University of Technology, Dept. Industrial Design Engineering; Kompan; Almende; Patching Zone; Innosportlab Sport en Beweeg; Sports & Technology; Driessens & Verstappen

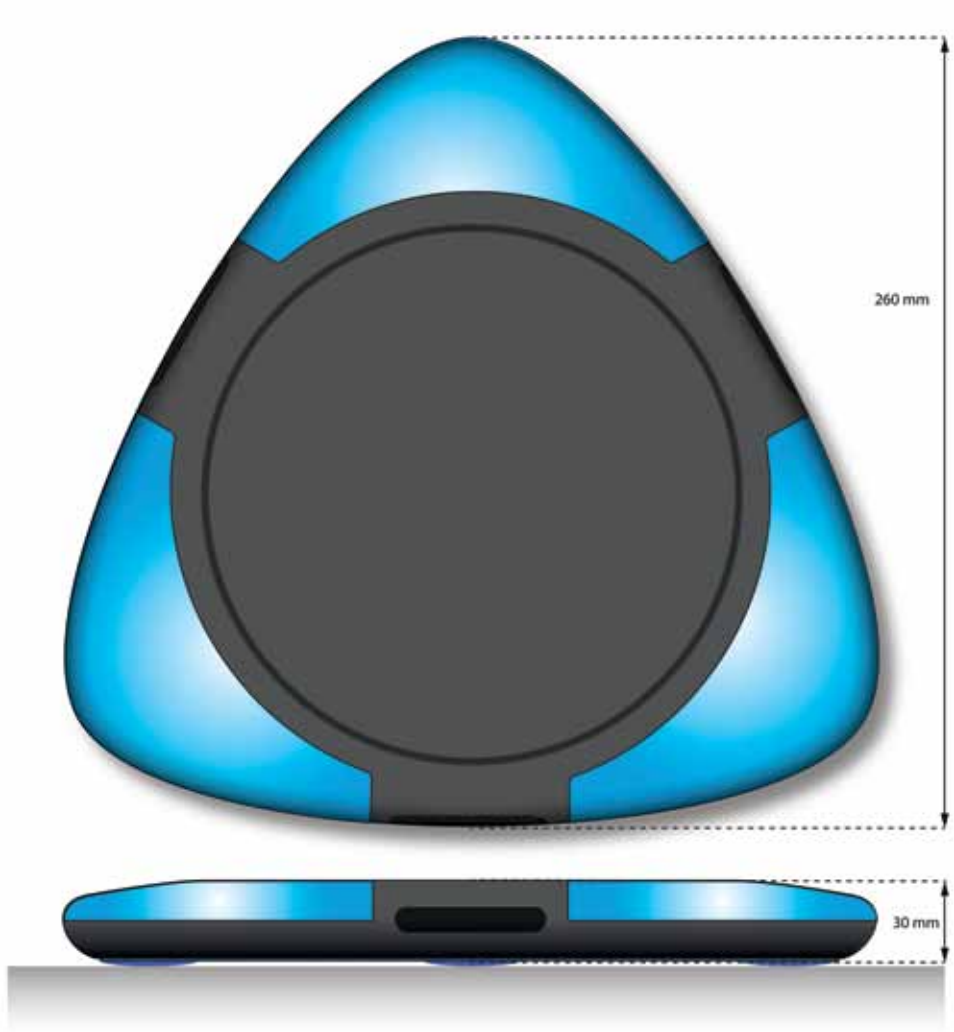
People
Eindhoven University of Technology, Dept. Industrial Design: **ing. Pepijn Rijnbout,** PhD candidate; **ir. Linda de Valk,** PhD candidate; **dr.ir. Tilde Bekker,** project leader and supervisor; **dr.ir. Mark de Graaf,** supervisor; **prof.dr. Ben Schouten,** promoter; **prof. dr.ir. Berry Eggen,** promoter; *Delft University of Technology, Dept. Industrial Design Engineering:* **prof.dr. Huib de Ridder,** researcher; **dr.ir. Arnold Vermeeren,** researcher; **dr.ing. Marco Rozendaal,** post-doc researcher.

While indoor gaming becomes more popular, children spend less and less time playing outdoors. As a result, children get less physical exercise. This project aims to make playing outside more attractive by integrating aspects of gaming, such as interactivity, into outdoor play objects.

An explorative study was carried out with a prototype called FlowSteps. This concept consists of interactive mats that react to children's movements with light feedback. Twenty children aged 7-8 years old played in pairs with the mats in free play sessions. Currently, improved prototypes are developed. In addition, a first version of a user experience assessment tool has been developed and evaluated in a study at Science Center Nemo in Amsterdam.

Eventually, the project will develop knowledge, methods and guidelines for design for social and active play. This knowledge will be shared with industry.

External funding
Fonds Economische Structuurversterking (FES);
CReative Industry Scientific Programme (CRISP).



Mobility

Design changes MOBILITY

Design can lead to innovations that contribute to a safe and sustainable environment and that are adapted to specific user needs. It can create solutions that support people's efforts to stay in touch with friends and families.

Trends

We live in a very busy world that is becoming more and more crowded. The risk of traffic congestion is ever increasing. We want to retain our mobility, but we need to transform our transport to become sustainable. We also want different transport solutions to be hygienic and safe.

Concrete examples, contexts

1. Design can make travel a safer and more pleasant experience.
   - Combining the use of smart materials and insights in human behavior in the design of a restroom for trains can lead to a more hygienic and friendly solution.

2. Design can develop novel transport solutions for different user needs.
   - Design can combine expertise from commuters, transport service providers, healthcare organizations and municipalities to create new product service combinations that help diverse user groups, such as the elderly, to be flexible, stay independent and active and to stay connected with friends and family.
   - Design can create solutions that fit people's values and combine the interest of the different stakeholders providing complete transport solutions.

Challenges

We want design to create complete solutions for an inclusive society. In addition we want to create transport solutions that make more efficient use of our decreasing fuel supply. Future challenges for Industrial Design therefore include combining knowledge about social processes, smart technology and logistic processes in an integrated development process.

Mobile landscape

Partners
University of Twente; Eindhoven University of Technology; Design Academy Eindhoven; Roessingh R&D; Tellens Groep; Trivium Meulenbelt Zorg; Zuidzorg; Divaco; De Loft; Indes; People Creating Value; Arriva; Connexxion; Waaijenberg Mobiliteit; Mia; Renault Munsterhuis; Ebretti Benelux; Fox Industries; Regio Twente; gCar; Life & Mobility; SOWECARE.

People
University of Twente: **ir. Rick Schotman,** Dept. Engineering Technology, PhD candidate; **ir. Vera Bulsink,** Dept. Bio-mechanical Engineering, PhD candidate; **Adrian Cooke,** MSc, Dept. Engineering Technology, PhD candidate; **ir. Marc Beusenberg,** Dept. Engineering Technology, assistant professor. ***Eindhoven University of Technology:*** **ir. Ehsan Baha,** Dept. Industrial Design, PhD candidate; **dr. Yuan Lu,** Dept. Industrial Design, associate professor, co-promotor; **prof. dr.ir. Aarnout Brombacher,** Dept. Industrial Design, promoter; *Design Academy Eindhoven:* **Maartje van Gestel,** Research Associate; **dr. Bas Raijmakers,** Reader.

Modern life demands people to be more and more mobile. However, increased mobility causes air pollution and traffic congestion. It is therefore necessary to develop novel mobility solutions.

Much everyday travel concerns 'normal traffic', i.e., trips covering relatively short distances in urban areas, such as shopping, visiting a doctor or seeing a friend. While such travel is often too far to cover on foot, using a regular car, which is designed for 'fast traffic', is unnecessary. The technical requirements for normal traffic can be totally different than those for fast traffic.

In this project, concepts of sustainable normal traffic solutions are studied, designed, built and/or tested in natural environments. Among the areas of attention will be electrical mobility solutions for elderly with reduced physical abilities. In addition, the general process of mobility innovation, which involves many stakeholders with different interests, will be studied.

Ultra-light urban mobility

Partners
Delft University of Technology; Cartesius Institute, Leeuwarden, The Netherlands; Mobiliteitsmanagement (SenterNovem).

People
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People's demand for mobility keeps growing. Increasing mobility, however, leads to urban congestion and air pollution. One possible solution to these problems lies in the use of alternative kinds of vehicles that are portable and earth-friendly. In addition, such alternative vehicles may create a new user experience which existing technologies and products do not provide.

In this project, new transport concepts meeting these requirements are designed and tested. One of these concepts is 'Drive-by-Wire'. This vehicle looks rather like an oversized skateboard. It has no handlebars, but is steered using a controller similar to those used in computer games. This approach allows the driving properties to be customized to the driver or the circumstances. Furthermore, the appearance of the vehicle can easily be changed. These innovations open up a range of new possibilities for designers.

External funding
Cartesius Institute, Leeuwarden, The Netherlands; Mobiliteitsmanagement (SenterNovem).

Train Toilet

Partners
Delft University of Technology, Faculty of Industrial Design Engineering; NS (Dutch Railways).

People
Delft University of Technology, Faculty of Industrial Design Engineering: **Marian Loth,** PhD candidate; **Daan van Eijk,** promoter; Johan Molenbroek, Co-promotor; **Bart Ahsmann,** Manager valorisation; **Bertus Naagen,** Lab manager **Tommy Louts,** Research Assistant **Fleur Derks,** Student Assistant

NS (Dutch Railways): **Mirjam Meier,** Customer and Innovation; **Boukje Bügel,** Commercial Director; **Eric van Eijndhoven,** Director Business & Product Development; **Marcel Ingenhoest,** Manager Product Development; **Rini Maas,** Project Manager Rolling Stock; **André Mast,** Cost Engineer Rolling Stock; **Kim Hauwert,** Market Researcher.

Train toilets are perceived to be dirty. People avoid using it, or even avoid taking the train because of the toilets. One of the reasons why train toilets become dirty is because the train shakes and the users have difficulties maintaining their posture. This project investigates what types of toilet design can improve train toilet hygiene.

A full-scale train toilet mock-up was created to test various designs. To solve the problem of spilling caused by urinating in a standing position while the train moves, a urinal was integrated into the design. Additional facilities were developed for seniors, wheelchair users and parents with small children, such as brackets, toddler steps, a diaper changing table and a toilet seat with a wide rim for extra support. These innovations improve train toilet hygiene so that taking the train becomes more attractive.

External funding
NL Agency.

Work

Design changes WORK

Design can impact our working lives by creating more pleasant work environments and decreasing stress at work.

Trends

People work for a longer part of their lives than ever before. In some domains work becomes more stationary. Both developments may increase health risks. People like to develop skills during their working lives and personalize their work environment to their own wishes and needs. Creating a pleasant and healthy work environment therefore becomes more important.

Concrete examples, contexts

1. Design can contribute to creating a pleasant and healthy work environment.
   - Providing pleasant lighting conditions that adapt to work activities can improve creativity and work effectiveness.
   - Combining smart technologies with complete lighting systems can lead to applications of light that improve the work experience, and can adjust to specific user needs.

2. Design can impact the quality of the products and tools in the workplace.
   - Design can integrate knowledge about material properties with special work related requirements to optimize performance.
   - Musical instruments can be adjusted to suit individual differences and preferences.
   - By combining knowledge about novel 3D printing, musical properties and individual preferences, a process can be created that leads to personalized work tools or instruments.

Challenges

Future challenges for the design discipline include how to combine knowledge about materials and smart technologies into complete solutions that adjust their behavior to the wishes and needs of different users over time. Furthermore, new tools and techniques need to be developed that support companies in applying knowledge about good work practices in a user and experience centred design process.

Future Office Lighting

Partners
Intelligent Lighting Institute, Eindhoven University of Technology; Philips Research.

People
Eindhoven University of Technology, Dept. Industrial Design:
ir. Serge Offermans, PhD candidate; **ir. Remco Magielse,** PhD candidate; **dr.ir. Harm van Essen,** supervisor of PhD candidate; **dr.ir. Joep Frens,** supervisor of PhD candidate; **prof.dr.ir. Berry Eggen,** promoter; **prof. dr.ir. Caroline Hummels,** promoter.

Developments in LED technology allow us to embed large numbers of interconnected light sources in our environments. This creates opportunities for systems to become more intelligent and adapt to the needs of users. However, traditional interaction methods (a separate switch for each light source) will become impractical. This project investigates new kinds of lighting control.

A wireless lighting platform has been developed that allows for testing of various methods of lighting control in realistic contexts. Different interfaces can be used simultaneously to control the lighting. In this exhibition, three of these interfaces are presented. One of the designs is a light switch for an office break-out area. Users can slap the switch to get immediate, functional lighting for a meeting, whereas colored or dimmed settings, suitable for having a drink, can be obtained by stroking actions. Alternatively a tablet interface or a physical cube can be used to control the lighting.

3D printed saxophone mouthpieces

Partners
The Royal Conservatoire, The Hague; Amsterdam Winds; David Liebman.

People
Jouke Verlinden, MSc, Dept. Industrial Design Engineering, Delft University of Technology, researcher; **Zjenja Doubrovski,** MSc, Dept. Industrial Design Engineering, Delft University of Technology, PhD candidate; **Valerio Lorenzoni,** MSc, Siemens Wind Power A/S.

The sound and playability of a saxophone is to a large extent determined by the geometry of its mouthpiece. However, the variety of commercially available geometries is limited. This project investigates how 3D printing techniques can be used to design and manufacture personalized saxophone mouthpieces that create the desired sound and feel for individual players.

In close cooperation with a number of professional saxophonists, new geometries are designed and printed. The players try out the mouthpieces and rate their sound and playing qualities. Several iterations may lead to personally optimized geometries.

Eventually, the project will lead to 1) knowledge on the relation between mouthpiece geometry and sound; 2) a workflow to design, customize, and produce new mouthpieces; and 3) the possible start of a new business in this niche market.

Gather complex data, simply

Partners
Eindhoven University of Technology; DESIRE Network of the Marie Curie Programme.

People
Nikolaos Batalas, Dipl.Eng, PDEng, Eindhoven University of Technology, Dept. Industrial Design, PhD candidate; **prof.dr. Panos Markopoulos,** Eindhoven University of Technology, Dept. Industrial Design, promoter.

Modern research in social sciences increasingly relies on data collection from participants. The resulting data sets are large, variable and complex, combining the output of various hardware, software and human sources. Software for collecting such data is often developed specifically for one or two studies, after which it becomes obsolete, e.g. because new hardware is used.

In this project new data collection software, called 'Tempest', is developed which circumvents these drawbacks. Tempest focuses on ease of use and deployment, on making use of participants' own devices, and on long-term reliability. A test version of Tempest has been used to collect data on the consumption of video in a home entertainment setting. The results were very positive.

Eventually, Tempest will be made freely available on the internet. Researchers will be able to adapt it to their individual needs and use it in various applications.

External funding
DESIRE Network of the Marie Curie Programme.

Managing Product Usability

Partners
Delft University of Technology; Eindhoven University of Technology; University of Twente; Philips; Océ Technologies; Thales; Unilever; Indes; SenterNovem.

People
dr.ir. Jasper van Kuijk, Delft University of Technology, Dept. Industrial Design Engineering, researcher; **drs. Heimrich Kanis,** Delft University of Technology, Dept. Industrial Design Engineering, researcher; **dr. Henri Christiaans,** Delft University of Technology, Dept. Industrial Design Engineering, researcher; **prof.ir. Daan van Eijk,** Delft University of Technology, Dept. Industrial Design Engineering, promoter.

Electronic consumer products, such as portable music players and mobile phones, are becoming increasingly hard to use. They are equipped with more and more functions, are becoming smaller, and are being used in a large variety of contexts and networks. This project aims to help companies improve their user-centered design approach and create more usable electronic consumer products.

First, three case studies were carried out. These led to a description of how usability is dealt with in product development of electronic consumer products, an overview of barriers and enablers for usability, and models of usability in product development.

Next, this knowledge was translated into a set of 25 cards. Through pictures and text, each card gives a recommendation how to organize product development if the goal is to make usable electronic consumer products. The cards were freely distributed and are now widely used in industry.

External funding
IOP-IPCR.

Smart Chair

Partners
Delft University of Technology; Hogeschool Windesheim; BMA Ergonomics; Salland Electronics.

People
ir. M. Netten, Delft University of Technology, Dept. Industrial Design Engineering, researcher; **prof.dr.ir. R.H.M. Goossens,** Delft University of Technology, Dept. Industrial Design Engineering, researcher; **Bas van der Doelen,** Eur. Eug. Ergonomist; **ing. Eelco Mensinga,** BMA Ergonomics, Industrial developer; **ir. Harmen Leskens,** BMA Ergonomics, Industrial developer; **ing. Frank Hoving,** Salland Electronics, Embedded Software developer; **ing. Hilco Piel,** Salland Electronics, Hardware developer.

Good posture is a Buzz away

More and more people perform their work sitting down. Even on well-designed office chairs, bad sitting posture can lead to health problems such as back pain. Explaining users about the correct sitting posture hardly improves posture in practice.

In this project, the responsibility for assuming correct posture is transfered from the user to the chair. A 'Smart Chair' was fitted with six pressure sensors and one angle sensor. Every second the chair calculates a grade indicating the quality of the sitting posture. When the grade is too low for too long, the user receives feedback through a vibration signal under the right thigh. Extensive user tests have shown the chair to have a significantly positive effect on sitting posture.

The chair has been developed into a commercial product called Axia Smart Chair. In addition, the sensor and feedback technology is separately available to be built into other chairs.

External funding
EFRO programme.