ID project
long descriptions

2011-2012 – Q1 & Q2

Comfort and Bonding in Health Care
Smart Sleep

Introduction and background project
Professor Eus van Someren, of the Netherlands Institute for Neuroscience (NIN) recently presented his latest work at the Kempenhaeghe conference. Central to his presentation was his group’s discovery that our skin temperature is a determining factor for the quality of our sleep. By controlling people’s skin temperature through a heated/cooled suit he was able to give people with insomnia more solid, uninterrupted sleep.

Design challenges / research questions
On the basis of his research van Someren expected that a heated/cooled bed (mattress and cover), capable of recording skin temperature and act upon it, would provide better sleep to its users.

Other approaches, discussed with van Someren is the use of a nightcap. We lose the largest amount of heat through our head, and the forehead is a well known place to influence body temperature (as with wet towels there when febrile). For a more consumer friendly design we therefore want a heating/cooling nightcap, controlled by skin temp.

Also the advantages of so called “power naps” are becoming more clear, being both beneficial to productivity and safety. What is lacking is easy control over the amount of a power nap (i.e. very short nap, full REM cycle, full sleep cycle) giving the user the confidence and ease to do a power nap. The design challenge would therefore be to create a programmable design to put the user in control over his own power nap.

An offshoot of the nightcap idea is to investigate whether people in hot environments could benefit from having personal cooling, for instance on the forehead. This could be an alternative for room air conditioning, and is expected to be far more energy efficient. It could also benefit people working outside in hot environments. This has been theoretically proposed by Kiva BV (company Peter van de Graaf), and would be interesting to investigate as a comforting and more sustainable technology than air conditioning.

Stakeholders
This project will be coached by

Loe Feijs, professor, is an expert on design of health care applications, product semantics, and bio-feedback.

Peter van de Graaf is an expert on innovative design for health care applications, and co-owner of Kiva BV.

Several industrial partners (Royal Health Bed, Philips, Kiva), clinical professionals (NIN, van Someren, Kempenhaeghe), are interested to support the project with expertise.

Development theme
Comfort and Bonding in Health Care

Sleep and body temperature are key factors in peoples comfort and health. The project addresses comfort and bonding in health care design, which shall contribute to develop knowledge regarding the mission of ID and four key issues of the theme:

- How to improve comfort and home care by unobtrusive health monitoring?
- How to enhance social bonding of patients, family members and friends?
- How to evaluate design decisions in the development of health care applications?
- How to design business models that attract valuable partners to establish a viable consortium in health care areas?

References / information sources

For more information regarding Van Someren’s work:

http://www.nin.knaw.nl/research_groups/van_someren_group/

Nap controller:

http://www.bbc.co.uk/news/world-us-canada-13232034

Original concept by Kiva.

Possible for:

B1.1 (smart bed, nightcap) to M2.2 (all)
Comfort and Bonding for Elderly Care

Introduction and background project
The continually increasing of ageing population poses challenges on long-term care for elderly. Unobtrusive monitoring and ambient assistive living are important for the independence and quality of life of the elderly. At TU/e and TNO, we have developed wearable sensor systems for unobtrusive monitoring and graphical tools/methods for designing interactive systems. Together with IMEC NL, we have designed a smart photo frame for arousal feedback. Wireless communication and flexible OLED could be integrated in the further development. In this project, students will explore a broad range of aspects related to both physical and emotional activities involved in elderly care. Topics of interests include comfortable posture monitoring with wearable sensors, emotion monitoring and feedback, design for assisting blind people and improving patient-medical staff communication via humane diagnostics. This project is suitable for students from B2 to M22.

Design challenges / research questions
Since the users are elderly who may be inexperienced with new designs and technologies, unique challenges are posed to the design, function and usability of the proposed project. Firstly, design for comfort is a challenge, because to understand the users’ needs and requirements, close contact with the end user and stakeholders are important for user research and testing. Secondly, it is challenging to create applications for comfortable posture monitoring and emotion monitoring, because the design is expected to improve comfort and bonding of the elderly and attractive for them to use in their daily life. Thirdly, how to devise a way to improve social bonding (e.g., create the right social distance with the blind people and chosen people) is a challenge. Fourthly, there are challenges for designing interactions to reestablish the contact between the cared and the care givers.

Stakeholders
This project will be coached by

Weichen, assistant professor in DI group, is an expert on unobtrusive sensing and comfort monitoring.

Peter van de Graaf is an expert on innovative design for health care applications.

Obrenovic Zeljko, assistant professor in the UCE group, has developed Sketchify, a tool for sketching interaction.

Several industrial partners (TNO, IMEC NL, 3M Optical systems), clinical professionals (Catharina Ziekenhuis), and an end user (Huub van Gerwen) are interested to support the project with expertise.

Development theme
The project addresses comfort and bonding in health care design, which shall contribute to develop knowledge regarding the mission of ID and four key issues of the theme:
Comfort and Bonding in Health Care

Project code

- How to improve comfort and home care by unobtrusive health monitoring?
- How to enhance social bonding of patients, family members and friends?
- How to evaluate design decisions in the development of health care applications?
- How to design business models that attract valuable partners to establish a viable consortium in health care areas?

References / information sources

For more information regarding the posture monitoring, see


For information regarding the emotion monitoring, see

Kimmy Ansems, Wei Chen, Lindsay Brown, “Smart Photo Frame for Arousal Feedback - Wearable sensors and intelligent healthy work environment”, accepted by workshop on Smart Offices and Other Workplaces of the 7th International Conference on Intelligent Environments - IE’11, Nottingham Trent University, United Kingdom.


Sensing for the blind:

graduation work of John Helmes at ID
NICU of the future

Introduction and background project
(Why this project offered, how is it embedded in existing work and theories, what is the outcome of previous projects?)

At the ID faculty a few steps have been made to improve the NICU, focusing specifically on the reduction of stress by re-designing the monitoring system and mediated contact parent-infant contact while being separated. With these projects various visions on the future of the NICU have been generated as a byproduct. This triggered the question what the NICU of the future could look like? Are there still incubators? Are parents present 24/7 or do they tele-visit their babies? Are nurses replaced by robots? In this project we ask you to design the NICU of the future concerning the topics comfort and bonding. In this project we want you to individually develop your own vision and translate and realize into it into a design of the NICU (or one of its elements). These visions and realizations can be selected and combined in order to create an actual NICU of the future experience environment in the Neonatal Lab.

To facilitate you into better understanding what you are designing for various activities will be organized. Think about a visit to an actual NICU, lectures/discussions on medical design and trend watching, etc.

Topics of interest are:
- Trend watching
- Vision development and exploration
- Aesthetic Design
- Prototyping

Design challenges / research questions
(What design challenges and research questions does this project aim to tackle? Do not specify them per block, but describe these challenges and questions in general.)

Because of the broadness of the project the scope can be tailored to your own personal goals. Both design and research challenges are encapsulated into the project. Bachelor students will be asked to pick one topic/element of the NICU, a list of proposed elements to select from will be provided beforehand. Furthermore, we will provide various trend watcher’s visions/quotes and you will be asked to combine these two into your own design and realize it into a working prototype. Master students free to propose their own a new element of the NICU or choose the NICU as a whole. We expect that the master students will dive more deeply into the subjects of future trends and take their own vision, a trend watcher’s vision or a statement as a starting point. These will then also have to be realized into a design and result into a working prototype.

For research semester students several approaches are possible. Depending on the students’ ideas about research methods and such, a plan will be made to facilitate the project.
Comfort and Bonding
in Health Care

Stakeholders
(Who are participating as coaches, experts, clients etc. and give a few lines per person/institute to introduce them and their expertise)

Prof. dr. Sidarto Bambang Oetomo, MMC (client): professor, neonatologist, expert on neonatology and medical clinics.

Dr. Wei Chen: assistant professor, expert on unobtrusive sensing, smart sensor systems for ambient intelligence, and neonatal monitoring.

Prof. dr. ir. Loe Feijs: professor, expert on design of health care applications, product semantics, and bio-feedback.

Dr. ir. Frank Delbressine: assistant professor, expert on mechanical engineering, manufacturing, engineering materials, rapid prototyping, mechanics, precision engineering and systems modeling, and health care system design.

ir. Sibrecht Bouwstra: Industrial Designer and expert in the design, prototyping and development of (medical) products. Sibrecht is also an expert in the bonding in the context of the NICU.

ir. Zhihui Zhang: An expert interactive system research, design and development. Zhihui is also an expert in comfort in the context of the NICU.

ir. Misha Croes: Industrial Designer and expert in the design, prototyping and development of (medical) products. Misha is also an expert in bonding in the context of the NICU.

Development theme
(How does this project support and develop the vision and mission of the Theme and of ID)

This project supports and develops the vision of the theme as a whole in the specific application area of the NICU. By making sure students develop a personal vision on the future of the NICU and then realizing this vision in working prototype, we believe a strong development can be guaranteed. The ultimate goal of these prototypes is than that we can collect them in a new neonatology experience lab. Where we can invite possible clients and other interested parties and show our developments, vision, and mission of not only the theme but of the whole department.

References / information sources
(List here previous students projects, literature, websites, and any other relevant material)

Depending on the topics various literature can be found:

Comfort in neonatal monitoring:
http://www.smartjacket.id.tue.nl/
http://www.idemployee.id.tue.nl/w.chen/
Audio and visual feedback for neonatal care:

Wireless communication design for comfort care:

Wearable body temperature and SpO2 monitoring for neonatal comfort:

Bonding:
To get a clear literature overview of bonding: Jarno Jansen – Breastfeeding and the mother-infant relationship – a review - 2008
Graduation thesis ir. M. Croes – FamiliyArizing-Designing connectedness between parents and their premature newly born - 2010
Mediated contact – How to connect?

Introduction and background project
(Why this project offered, how is it embedded in existing work and theories, what is the outcome of previous projects?)

Over the years various products have been integrated in hospitals for mediated contact between parents and their premature baby in the NICU. One is a webcam application that allows parents to observe their baby admitted to the hospital anywhere through an internet connection. Another is the recording of interaction while in the hospital and reliving the moment while away, called video interaction guidance. Furthermore, a recent graduate project of Misha Croes enabled parents to console/hug their baby while being physically separated. These techniques of mediated contact are believed to support parents during the difficult times and preferably bring them closer to their baby. The bonding process can be approached from parent to baby and also the other way around. In this project we propose the design challenge of designing for improved bonding as well as research topics on the effect of the proposed design interventions.

Design challenges / research questions
(What design challenges and research questions does this project aim to tackle? Do not specify them per block, but describe these challenges and questions in general.)

This project entails both design goals as research questions. For design projects we would like the students to think about what, and how to design for mediated contact in the context of the NICU. What will help to bring the parents and babies feel closer together now that the baby is not at home? What is desired by parents, babies, doctors and nurses? How will your design fit into the everyday life of these people, taking in account e.g. their jobs, the baby’s siblings and traveling to the hospital? And how can design contribute to this challenging period/environment? What does parent-infant bonding, while they are being separated, look like? These are all design considerations we want you to think about, design for and realize into working prototypes.

For research students the main question is what the effects of such design interventions on the various stakeholders are and if the designs actually bring people closer together. What impact do such interventions have? And which parameters of the design are responsible for the impact? Touch, sight, motion, facial expressions, reciprocation? Or, investigate what is desired/expected of such design interventions in the first place.

To give a possible foothold for students we advice the Ronald McDonald House (RMH) as an extra client next to the Maxima Medical Centere’s NICU department. Recent shared observations of NICU nurses have expressed that the atmosphere at the RMH has an impact on the visiting behavior of parents. Again for both design as well as research students this can be a very interesting connection in the context of mediated contact.

Stakeholders
(Who are participating as coaches, experts, clients etc. and give a few lines per person/institute to introduce them and their expertise)
Comfort and Bonding in Health Care

Client: Although the Maxima Medical Centre Veldhoven will be the initial client of the project, also parents and their stay at the Ronald McDonald house are applicable clients.

dr. Wei Chen: assistant professor, expert on unobtrusive sensing, smart sensor systems for ambient intelligence, and neonatal monitoring.

prof. dr. ir. Loe Feijs: professor, expert on design of health care applications, product semantics, and bio-feedback.

Dr. ir. Frank Delbressine: assistant professor, expert on mechanical engineering, manufacturing, engineering materials, rapid prototyping, mechanics, precision engineering and systems modeling, and health care system design.

ir. Sibrecht Bouwstra: Industrial Designer and expert in the design, prototyping and development of (medical) products. Sibrecht is also an expert in the bonding in the context of the NICU.

ir. Misha Croes: Industrial Designer and expert in the design, prototyping and development of (medical) products. Misha is also an expert in bonding in the context of the NICU.

Development theme

(How does this project support and develop the vision and mission of the Theme and of ID)

This project is mainly focused on the bonding element of the theme in the NICU application area. However, if designed properly, mediated contact can also result in comfort for the various stakeholders. Therefore, we believe that this project provides a strong, but specific, support to the development of the theme’s vision and mission.

References / information sources

(List here previous students projects, literature, websites, and any other relevant material)

Depending on the topics various literature can be found:

Bonding:

* A clear and compact literature overview of bonding is provided by: Jarno Jansen – Breastfeeding and the mother-infant relationship – a review – 2008

* Graduation thesis of Misha Croes – FamilyArizing – Designing connectedness between parents and their premature newlyborn - 2010
Medical Simulation and Team Training

Introduction and background project
(Why this project offered, how is it embedded in existing work and theories, what is the outcome of previous projects?)

In the Netherlands 7-8% of the babies are prematurely born. These neonates are highly susceptible for cardiac and respiratory diseases because of immature vital organs. Team training of medical staff, e.g. assisting in deliveries to correctly assess the health of a newborn, is important to reduce the number of (fatal) errors. To correctly train these medical teams, all kinds of simulations and simulators are needed, since experimenting on real patients is unethical and therefore not allowed. To perform a correct health assessment in simulations, simulators are needed that show the external phenomena and produce the internal phenomena used for e.g. scoring a newborn’s health state. To be able to draw any conclusions about the training a certain level of realism is important to get suspension of disbelief and let the medical staff behave like they would when e.g. assessing a real premature baby.

Design challenges / research questions
(What design challenges and research questions does this project aim to tackle? Do not specify them per block, but describe these challenges and questions in general.)

The objectives are to design and realize aspects needed to simulate patients for team training realistically, e.g. a manikin of a premature baby to be used for team training of medical teams. For a baby manikin we currently focus on APGAR score, a simple and repeatable method to quickly assess the health of newborn children immediately after birth. In this method five criteria are scored: skin color, pulse rate, reflex irritability, muscle tone and breathing. Work has been done on breathing, skin coloring, heart rate and CPR, but these topics still need more attention. A manikin of premature baby size is the target; current proposed solutions in previous projects need significant miniaturization. Aiming at simulation, considerations will have to be made how to control several implemented features by e.g. a microcontroller. Another aspect to address is team cooperation and communication. What can be done to improve cooperation and communication in a medical team when working in situations causing high stress levels? How can cooperation and communication be monitored in team training sessions?

Stakeholders
(Who are participating as coaches, experts, clients etc. and give a few lines per person/institute to introduce them and their expertise)

Máxima Medisch Centrum is the hospital in Veldhoven. The gynecology department is a partner in this project

Sidarto Bambang Oetomo is gynecologist at the Máxima Medisch Centrum. Expertise is (of course) gynecology.

Frank Delbressine is an expert in mechanical engineering.

Peter Peters is an expert in electronics and software engineering.
Development theme
(How does this project support and develop the vision and mission of the Theme and of ID)

The project addresses the topics team bonding and improvement of medical healthcare in perinatology.

In team training sessions usually an emergency situation is simulated to assess how well a team cooperates and handles the situation. The team interaction heavily depends on roles each team member has, and how well these are performed. People who are responsible for a specific task within the team have to take that responsibility and have to act and communicate accordingly. In teams where this is well executed, fewer misunderstandings happen and fewer errors will be made. Improving cooperation and communication will also have positive effects on team bonding; working in a well-functioning team improves the social bonds between the team members.

Team training can also be used to get, maintain or increase a certain skill level, especially for situations that are rare and therefore real-life experience is hard to acquire. Using real patients is not possible, not only because the situations are rare, but also because of ethical restrictions. Using human patient simulators (HPS) is one of the ways to solve the lack of patients. For adult patients and full grown babies HPS are commercially available already. For premature babies this is not the case. Development of a premature baby manikin is therefore useful and fits perfectly well to the perinatology research and education topic of the theme.

The solution envisioned will be an intelligent system, simulating aspects of a premature baby, to be used in a medical environment, helping medical staff to get, maintain and improve social and medical skills.

References / information sources
(List here previous students projects, literature, websites, and any other relevant material)

DPG24 - Baby Manikin (2 teams)
DPG02 - Pulse development for a child birth baby manikin (M1.1)
FBP - Baby skin
FMP - Teamwork engagement analysis for design opportunities during neonatal resuscitation procedures – an explorative observation study


P. Peters, L. Feijs, and S. Oei, "Plug and play architectures for rapid development of medical simulation manikins", in Proceedings of the 12th World multi-conference

Motivating arm-hand use with games

Introduction and background project
The health system is under severe pressure with increasing number of patients. It is well understood that patients could receive much better health care and have a higher quality of life, if they could use interactive technologies for rehabilitation. This project focuses primarily on stroke rehabilitation (for adults) and cerebral palsy therapy (for children); however, arm-hand rehabilitation is relevant for several other pathologies: Parkinsons, MS, Spinal Injury. At TUE we are developing customizable tabletop tangible games, and wearable solutions for supporting arm-hand training. This project shall examine how to motivate patients, how to customize solutions to patients and pathologies, and how to allow remote therapist supervision.

Design challenges / research questions
A major design challenge for all these solutions refer to the need to personalize and customize solutions for patients. There is no good for all solution, and technology designers and developers, lack the domain expertise to address pathology specific questions and cannot be at hand’s reach when patient progress or special requirements for each patient need to be addressed. The design challenge is therefore to create open ended systems that allow for customization and adaptation by therapists and patients.

The second design challenge refers to continued motivation by patients. We are still far from creating solutions that will keep patients engaged for a longer period of time. This project seeks to apply motivation theories and theories regarding persuasion to design the feedback mechanisms and generally the interactive experience supported by rehabilitation technology.

Stakeholders
This project will be coached by Panos Markopoulos. Two PhD projects are carried out in relation to the Wikitherapist research project at the UCE and DI groups. Several clinics participate (Sint Maartens, Adelante, LibraZorggroep) and specialized technology manufactures (Serious Toys, Philips) who will support the project with expertise.

Development theme
The project shall develop knowledge regarding the four key issues of the theme comfort & bonding, in relation to arm-hand training:

- How to improve patient comfort and home care by unobtrusive health monitoring?
- How to enhance social bonding of patients, family members and friends?
- How to evaluate design decisions in the development of health care applications?
- How to design business models that attract valuable partners to establish a viable consortium in health care areas?

References / information sources
For more information regarding the wikitherapist research project; see www.wikitherapist.nl

For information regarding the rehabilitation of children with cerebral palsy, see http://www.springerlink.com/content/g46776732322n103/

For more information regarding the Serious Toys board, see http://www.serioustoys.com/en/the_big_idea.aspx
For information regarding wearables for stroke, see project of Freek Boesten (M2.2), project by Luuk Beursgens (M1.2) and Rik van Donselaar (B.3.2). A publication covering the first two is doi:10.1145/1979742.1979761
Social Media for People with Aphasia

Introduction and background project
(Why this project offered, how is it embedded in existing work and theories, what is the outcome of previous projects?)

Aphasia is an acquired communication disorder that is caused by brain injury or trauma. Aphasia affects language comprehension and generation, such that people’s ability to express themselves verbally suffers. People with expressive aphasia usually can understand or read what other people say or write but they have problems in expressing themselves verbally and in writing. The consequence of aphasia is that people have problems maintaining contacts with their friends and cannot participate in social exchange, which eventually can result in them becoming passive and socially isolated.

There has been a growing interest in improving the quality of life for people with aphasia through technological intervention. Especially off-line media seem a priori attractive for people with aphasia, as the need to communicate at the same pace as regular users can be largely circumvented in such case. In the PhD project of Abdullah Al Mahmud we have for instance developed an email program that is specifically intended for people with (expressive) aphasia, but that makes use of a mainstream infrastructure (i.e., gmail). This program is currently being tested in a longitudinal study.

Past student projects have looked at ways for people with aphasia to generate and collect in an intuitive way material (such as pictures) that they would like to share with other people. The next logical step is therefore to look at ways to actually share such collected material. Making use of the existing infrastructure for social media exchange seems advisable, not only for reasons of cost effectiveness, but also because this might support the social acceptance of proposed solutions (it has been shown that people with handicaps tend to dislike, and hence not use, products that somehow stigmatize them, even in cases where they bring clear functional benefits).

Design challenges / research questions
(What design challenges and research questions does this project aim to tackle? Do not specify them per block, but describe these challenges and questions in general.)

While people with aphasia can potentially profit much more from social media (such as facebook) than regular people, these media are not obviously accessible to them. The goal of this project is to develop adapted versions of social media that can overcome aphasic-related limitations, such as one-sided paralysis and problems in creating text from characters, without stigmatizing the users.

Specifically, a range of proposals should be developed that can be used in a subsequent comparative analysis. The proposed project is hence a first step in a research-by-design approach where design proposals are used to trigger a subsequent evaluation/discussion, which can in turn lead to new design requirements. One of the reasons for adapting this approach is that more traditional approaches of user involvement are less suitable, because of the limited expressive capability and the limited availability of both our target end users (aphasics) and their caregivers.
**Stakeholders**
*(Who are participating as coaches, experts, clients etc. and give a few lines per person/institute to introduce them and their expertise)*

Martens Jean-Bernard, professor on Visual Interaction, has introduced the topic of technological support for people with aphasia within the ID department and has supervised the Ph.D. work of Abdullah Al Mahmud. He also maintains contacts with the Blixembosch rehabilitation center, the Afasiecentrum Eindhoven (Jacinta van Beeck) and AVN (Afasie Vereniging Nederland). He also heads the ConceptLab and supervises a number of projects around conceptual design and creativity.

Obrenovic Zeljko, assistant professor in the UCE group, has developed Sketchify, a tool for sketching interaction. He also participates in the ConceptLab, where he specializes in multimodal interaction.

Jacintha van Beeck (Afasiecentrum Eindhoven) is a speech therapist and our primary contact person for expert information on aphasia and for contact with persons with aphasia.

**Development theme**
*(How does this project support and develop the vision and mission of the Theme and of ID)*

Creating interactive products is obviously part of the mission of ID. Most often this is interpreted as creating new functionality based on new or emerging technology. However, extending the access to existing functionality (with proven usefulness for regular users) to new user groups, such as people with aphasia, that are up to now largely excluded, is an equally valid approach, and one that obviously fits into the mission of the “Health” theme.

**References / information sources**
*(List here previous students projects, literature, websites, and any other relevant material)*

Website AVN: [http://www.afasie.nl/](http://www.afasie.nl/)