DUTCH – teaching method-based design

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1. About the authors

The first author has a master's degree in Cognitive Psychology and a PhD on Human-Computer Interaction. He was head of a Cognitive Ergonomics Department, and is now a full professor in Computer Science Departments in 3 Dutch Universities (Vrije Universiteit, Amsterdam, Universiteit Twente, Open Universiteit). He developed single courses on user interface design or design of interactive systems as part of Bachelor curricula in Computer Science, Cognitive Psychology, and for distance education, and as part of a Master in Ergonomics. He developed a full "(4 year) academic (Bachelor and Master) curriculum in Information Sciences titled "Multimedia and Culture" that included 6 design courses (website design, information representation, visual design, multimedia design, user interface design, text design, in total about ¾ student years), that were separate from, and based on courses on related theory as well as basic skills like multimedia programming and web programming.

The 2nd author has a mixed background in engineering, human sciences, and the arts, acquired through education, work experience in academia and industry, and other projects. His approach to HCI is inspired by his practical experience in the arts disciplines (electronic musical instruments, live video performance), design and architecture. At the Vrije Universiteit he has set up and taught over the last three years the HCI and User Interface Design courses.

The 3rd author has a master's degree in Advanced Computer Science. He is currently associated with Vrije Universiteit Amsterdam as a research student where he designed and taught a course on "Experience Design" and was a teaching assistant in a design related course on "Multimedia Authoring".

2. General design course structure

All design classes followed a systematic design approach, that, in an abstract way, can be characterized by figure 1. This approach is based on our design approach [1] that we labeled DUTCH (design for users and tasks, from concepts to handles).

Consequently, each course starts with collecting, modeling, and analyzing an existing situation. The next step is the development of a vision on a future domain world where new technology and / or new representations have been implemented. This second step is the first tentative global design that will be represented in scenarios or prototypes and can be assessed. This second design model is based on both the client's requirements and technological possibilities and challenges. In an iterative way multiple instantiations of detail design may follow, that each can be assessed and evaluated again.

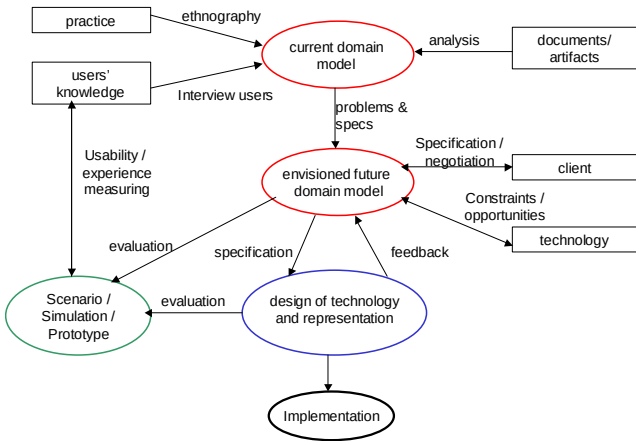

Figure 1. The DUTCH design approach.

3. Domains for design

Many different domains have been offered to our students, related to the actual focus of the courses. Some examples:

- websites for clients in cultural domains like music groups, artists, museums;
- video shows on restaurants in a major city;
- registration and payment tools for favorite clients of hotel chains;
- house style and visual identity for a major HCI conference

4. HCI as a base for teaching design

All design courses that we have been teaching supposed a basic course in human-computer interaction (HCI) as a base. As an

example we will discuss the HCI course at the Vrije Universiteit. That has been originally set up as part of the HCI, Multimedia and Culture program within the department of Computer Science. This course is compulsory for undergraduate students in the curricula Multimedia and Culture, Computer Science, Artificial Intelligence and Business Informatics. It is further attended by students from other departments such as psychology, and international exchange students. In the last years about 100 students are involved in the course per year.

The course consists of four *themes*:

- human factors
- technology
- design of interaction
- structured design methods

The first two themes provide background information about the two entities involved in the interaction: humans and computers. Both the physical aspects of the interaction and technology in general is discussed. An assignment is given to enable students to get familiar with understanding technologies by literally and/or functionally taking things apart (Device Parsing). The "design of Interaction" theme consist of lectures on information representation, communication theory, and multimodal interaction. Two assignments are part of this theme, one is about observing and describing information and signs in our everyday environment (Sign Subversion) and the other is about analyzing interactions. This theme accentuates the relevance of UbiComp or Pervasive Computing, bringing together technical issues, human factors, and insights from the field of architecture. An ecological approach is advocated, HCI in an electronic ecology or *e*-cology [3]

The "structured design methods" theme is strongly based on the DUTCH approach [1], and includes introductions to design research methods such as Cultural Probes, Scenarios, Personas, etc.

All lectures are supported by examples from the authors' own recent research practices.

The course web site was completely redesigned as a basis for e-learning in 2005 by Marcin Wichary. It contains information about the lectures and the people involved, background material about HCI, pointers to other sources, and interactive exercises such as a practical introduction to Fitts' Law. It is subject to the Creative Commons License, so other parties can extend or customize the material. In 2006 the site was further developed by Elbert-Jan Hennipman, an assistant lecturer in the course. It is now possible for students to enroll in the course, hand in coursework and check their progress. Further extensions are currently being developed, through the involvement of the Open University, with the objective to create a public domain full HCI e-learning environment.

5. Example of a design exercise

Two groups of design students working towards their European Masters degree in Ergonomics were involved in designing concepts of aware systems that allows monitoring and communication. One group was involved in designing for elderly (age 65+) and another was involved in designing for young kids (age 3 - 5). The focus of these design projects was to creatively develop a device that may be in use in 5 years time, considering prospective North American and European users. In future these designs might be applied in Kindergartens, Elderly-care Centers or in other similar institutions. From a functional point of view, the device should be able to help caretakers (who might be at a different but nearby location) keeping track of the users' whereabouts and communicate with them for any instructions or help.

Since the intended user groups were vulnerable and required constant care, one of the additional goals of the concept design was to provide experiential support to the product [2]. For the elderly and kids, being separated from their loved ones and living with strangers was emotionally challenging in itself. We were interested in finding out to what extent the designed product can support or improve these users' experiences.

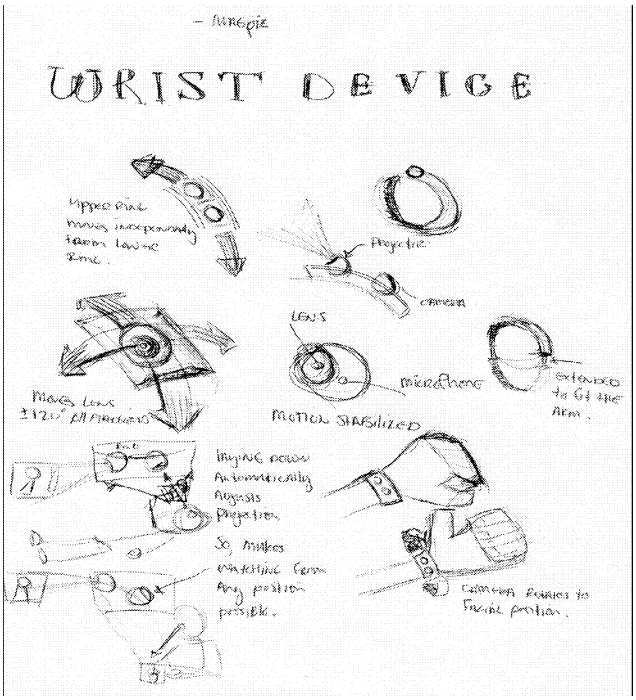

Figure 2. Early design sketch.

During the teaching sessions, we (the authors) introduced a conceptual design framework on experience to the students and allowed them to use it in their own preferred ways. Both groups started off with some in-depth interviews with the prospective end-users and professional caretakers – currently working in a similar type of environment. The groups then developed personas: resp. Thomas – a 3-year-old boy, and Weerd – an 82-year-old lady, to have a constant user focus during the design process. They collected the most common attributes and behaviors of the potential users in their respective personas. Keeping these personas as the main focus of their designs they started brainstorming within individual groups to use our framework as a checklist for adding creative features and to provide experiential

support. They tried to envision the implications on the functionality, interaction and appearance of their design from sensual, cognitive, emotional and practical points of views.

We asked the student designers to make a collection of their design ideas, any relevant information on their brainstorming sessions, design sketches and mock-ups that they develop while using this framework.

Both groups came up with devices that can be worn on the wrist. Figure 2 is an example sketch developed during a group's brainstorming session. They envisioned different sensing techniques to track users' movements, physical place, temperature, and heart rate using different physiological and behavioral cues. In the following, we show what creative and additional values the individual groups added to their designs.

Device for Elderly:

- The design group thought of having a jewelry-like device on the hand of persona Weerd, since she would love to wear it and feel attached to it. And since the device is on her hand, help is available 24/7.
- The group thought that having a jewel as the device would be easily accessible through her hand and it would make her feel that "there is someone constantly looking after me".
- To avoid any cognitive load while interacting with the device the group used speech interfaces for communicating with the elderly.
- The device gets warmer when another elderly with a similar sort of device in his hands comes close to Weerd. This could provide some social and emotional pleasure of using the device.
- An assistive feature was added into the device that would remind the users to finish their daily rituals especially when they are on medication. E.g. at a certain time the device would sound "You didn't take your pills today!".

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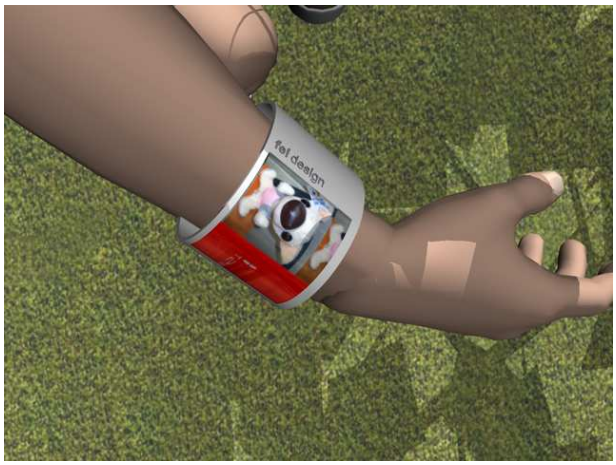

Figure 3: Design of the aware device for kids

Device for Kids (see figure 3 for a mock-up):

- After getting familiar with the framework the design group added elements of playfulness in their design. Persona Thomas, being a "Bob-the-builder" fan, would like to have a toy-like device tied on his hand.
- The device also supports Thomas emotionally whenever he feels lonely by allowing him to see his mother's face on the 2D display screen of the wrist device.
- Educational aspects were added at the interaction level. E.g. on disobeying instructions about forbidden locations, the device would vibrate and the send a message implicitly and even show his favorite pet Fluffy warning him. And on subsequently obeying the instructions the device would permeate a nice smell (candy).
- A sense of freedom was inputted in to the device. Thomas being a creative 3-year-old would not like being repeatedly interrupted by the device hence the device doesn't work as an assistant to the kid.

Figure 4: A mock-based scenario for Kid's Device

Both design concepts support work-critical functions (e.g., monitoring) and, at the same time, allow interaction to educate and support play (in the kids device) and build social relationships with others (in the elderly device). The final design concepts were presented as a combination of interface features and mock-up-based scenarios, during a stakeholder evaluation. Some example screen-shots from a presentation are presented in figure 4.

As an evaluation of these design concepts, we organized student presentations in the presence of relevant stakeholders. The design concepts were presented in the form of a list of interface features and mock-up based scenarios describing different contexts of use. The design concepts received positive reviews from the committee. Another way to evaluate these concepts could have been to carry out a user study. We chose not to do that because of the limited student time available for this course.

6. ACKNOWLEDGMENTS

Our thanks to Marcin Wichary and Elbert-Jan Hennipman for their contributions to the design and implementation of the HCI course material.

7. REFERENCES

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