

Eindhoven designs

volume one

TU  Technische Universiteit
Eindhoven
University of Technology

Editors:

Joep Frens
Oscar Tomico
Kees Overbeeke

Where innovation starts

Microsoft[®]

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Introduction

Department of Industrial Design, TU/e



Eindhoven University of Technology (TU/e) intends to be a research-driven, design-oriented university of technology at an international level with the primary objective of providing young people with an academic education within the 'engineering science & technology' domain. It aims to advance the development of technological innovations, leading to the growth of welfare and well-being, both within its own region (technology & innovation hotspot Eindhoven) and beyond.

In 2001, TU/e started the Department of Industrial Design. It is a rapidly growing department with almost 500 students, both Bachelor and Master, and around 80 staff members. There are more than a thousand industrial design courses around the world. Industrial Design at TU/e distinguishes itself through its focus on the design of intelligent systems, products and related services, through its unique education model and through its distinctive design process.

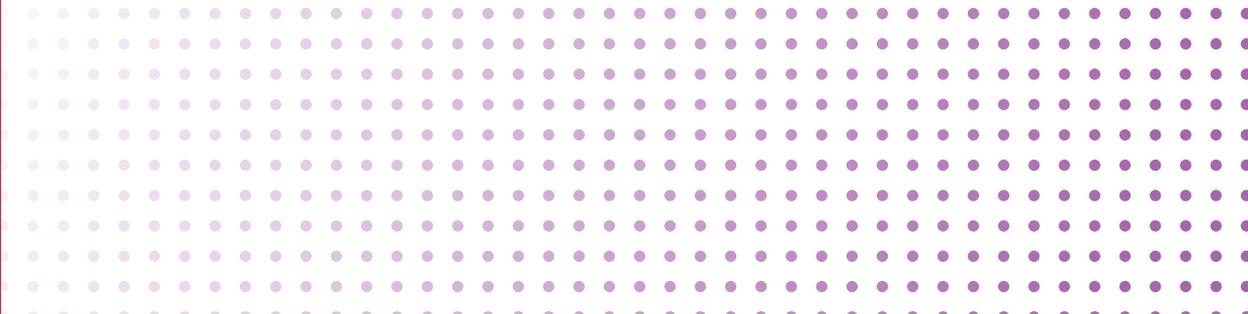


Focus

Based on discussions with industry, the department decided to concentrate on the design of intelligent systems, products and related services, which addresses such issues as adaptive behavior, context-awareness and highly dynamic interaction. Students learn to integrate various approaches in the design process, including human, socio-cultural, interaction, technological and business process aspects. Industrial Design at TU/e is based on three paradigms: design, engineering and social science.

Generating innovative concepts and original ideas is emphasized in the course. More specifically, we want

our graduates to be people who are able to transform our world, preferably in beautiful ways, instead of just solving problems. Because technology is so rapidly and innovatively created by the technology providers of the world, it is potentially capable of transforming our world, but not in ways that we (can) know of beforehand. So instead of educating students for analyzing the needs of users in existing product ecologies our aim is more radical: we want to educate students who are able to apply these new technologies in ways that are new and daring, driven by a design vision of what our world could be like, and validated afterwards by solid user research.



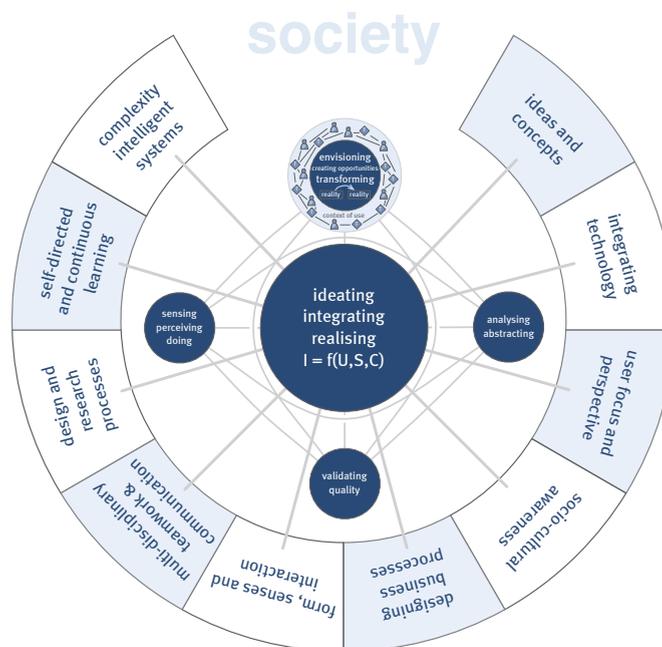
Educational model

Taking into account recent developments in both the professional and educational field, the ID course was based on an educational model in which competency development and self-directed learning are pivotal. We give students, or 'junior employees' as we call them, a professional role to create opportunities within a professional setting. Competency-centered learning gives equal weight to knowledge, skills and attitudes, and stimulates students to learn by doing. Within our department, a competency is defined as an individual's ability to select, acquire, and use the knowledge, skills, and attitudes that are required for effective behavior in a specific professional, social, or learning context. Therefore, it offers a holistic view of design, which the student integrating ten competency areas: Ideas and Concepts, Integrating Technology, User Focus and Perspective, Social-cultural Awareness, Designing Business Processes, Form, Senses and Interaction, Multidisciplinary Teamwork & Communication, Design & Research Processes, Self-directed & Continuous Learning, and Complexity Intelligent Systems (see figure, outer circle).

Designing Business Processes, Form, Senses and Interaction, Multidisciplinary Teamwork & Communication, Design & Research Processes, Self-directed & Continuous Learning, and Complexity Intelligent Systems (see figure, outer circle).

The nature of design beautifully intertwines the different types of knowledge with different human skills, in this case cognitive, emotional and perceptual-motor. It is about learning and performing through practical application, while simultaneously acquiring theoretical skills. For example, design uses formal scientific notations (based on mathematics) as well as knowledge that is harder to formalize (e.g. aesthetics and creativity). Moreover, knowledge can be obtained through the analytical skills of the designer (e.g. analyzing user behavior), as well as through the synthetic skills of the designer (e.g. building physical models).

In addition to skills and knowledge, competency development also focuses on the designer's attitude, such as taking responsibility and professionalism. Competency-centered learning is a highly person- and context-dependent process. A different context requires different competencies and different students will choose to focus on different competencies and develop them differently. Therefore, our students take responsibility for and create their own program. They can choose assignments and modules that best match their learning goals and required competency development of that semester. All this, of course, within the structure and content the department provides and with the help of senior employees (staff) who serve as project coach, competency coach, and expert. Moreover, students work on projects with different clients and experts, which in turn tunes their competency development.



Design process

We noticed that our foundations, intelligent systems, products and related services, and competency-centered learning, have implications for the design process we want to teach our students. That is why we developed a design process that fits our foundations. We call it the reflective transformative design process.

This design process consists of five activities that take place within the societal setting, but without a specific order (see figure, inner circles). Depending on the person, context, or phase within the design process, the students determine where they start, how often they switch from one activity to another (we stimulate frequent changes), and in which order they complete the activities. The process thus supports flexibility and individuality. Moreover, every time the students switch activities an opportunity for reflection occurs (grey lines). This helps students who are new to design

to train their reflective practice. The activity that is central to the process is ideating, integrating and realizing interaction solutions between users and systems in a context of use (central circle). In this continuing process, the designer gains insight into the design opportunities. During the process, these insights are physicalized and result in a final proposal. The development of this proposal is guided by a vision (top circle), in our case a vision about transformation from our current reality to a new one through an intelligent system, product or related service. We encourage students to search for innovative solutions that are meaningful and valuable for users and for our society. This means that students need to develop a sensibility for the ethical aspects of what it means to intervene in people's lives. Because meaningfulness and value are person- and context-related issues, we believe that the proposals should be

tested in society (bottom circle). In order to validate the quality of the vision and the proposals, experiencability of the proposal is crucial, by the designer himself but also by others in a real-life setting.

The two remaining circles show the two types of skills the designer uses to develop proposals. Knowledge and skills, the cognitive skills of the designer (right circle) as well as his perceptual-motor and emotional skills (left circle), are integrated.

We view the design process as a process that leads to insight into the design opportunity and solution domain by continuous information gathering. In our design process there are two drives for information gathering. The first drive is information gathering to direct the design decisions through a vision (the top circle). The second drive is information gathering to validate design decisions (the bottom circle). These drives are incorporated within two strategies that generate information and that reciprocally provide focus for each other:

The first strategy revolves around design action (left circle). It produces experiential information that feeds into the connecting circles. To be more specific, the information that is generated by design action takes the form of visualizations/ physicalizations that naturally feed into the middle circle as integrations of a designer's knowledge, skills, and attitude. At the same time, these visualizations/ physicalizations act as reference points for the ever-growing design vision and as input for validation. Finally, design action provides focus for and steers further analysis.

The second strategy revolves around analysis (the right circle). It produces a more formal kind of information that (again) feeds into the connecting circles. Common sources for this formal information include (but are not limited to) literature and contextual inquiry. The information can be used to direct or to corroborate design decisions from the middle circle. In addition, the formal information provides focus for and steers further design action.

Projects

The student projects for the Microsoft Research Design Expo presented in this book are a result of the above-mentioned foundations and approach. We regard the designerly skills instrumental in creating the future generation of subtle, nuanced and beautiful interactive product proposals, in this case proposals in the realm of 'Learning and Education', which is the theme of the Microsoft Research Design Expo. We hope that the results presented in this book show that it is our aim to 'educate unique opportunity creators for societal transformation through intelligent systems' and we would like to thank Microsoft Research for offering this opportunity for our students and for our department.

Caroline Hummels



Theme

Introduction

Each year Microsoft Corporation invites a number of universities to participate in the Microsoft Research Design Expo. Microsoft thus provides a forum for creative thought and innovation and offers students the opportunity to explore the future of computational power within a specific theme. In 2008, the TU/e Department of Industrial Design was invited to participate for the second time together with seven other institutions with established

programs in design: Pasadena Art Center (USA), Carnegie Mellon University (USA), Beijing Central Academy of Fine Art (China), University of Dundee (UK), Rhode Island School of Design (USA), Universidad Iberoamericana (Mexico), and the University of Washington (USA).

The theme of the Microsoft Research Design Expo 2008 is 'Learning and Education' It aims to showcase exceptional design processes and ideas:

"The 2008 design challenge explores the importance of learning and education. We can improve the daily life of a wide variety of users through learning and education: from promoting creativity and curiosity in new topics, to demonstrating novel ways of providing instruction, to rethinking education systems and tools. In addition, we hope students think about learning and education in a variety of cultures and learning styles.

Although learning & education is a broad, universal topic, projects should be designed for the needs of a particular user group in a particular situation or culture. Users groups may include: mobile "learner", online community, preschool, elderly, office workers, individuals who share a particular learning disability, visual or hearing impaired, different roles (student, peer, teacher, social network, and researcher), etc.

We encourage you to think beyond traditional software, toward solutions such as lightweight user interfaces for inputting (entering) and outputting (disseminating information) which integrate with everyday life."

Taken from the Guidelines for MSR Design Expo 2008

Microsoft®

Design concept and direction / main objectives

The goal for the projects was to address not just one issue but to explore the extent of design opportunities for 'Learning and Education'. Therefore, part of the design challenge was that the students themselves choose and define the target group and the social and physical context within the theme while still achieving the educational goals of the 'Design for Interaction Master Class' at TU/e. Their design concepts had to fit in with the vision of the TU/e Department of Industrial Design as described in the introduction of this book.

Twenty-five TU/e Industrial Design students took part in this design challenge during the spring semester 2008. They were divided into six groups, each consisting of two to five students. In six weeks, distributed over the semester in blocks of two weeks, they proceeded from the brief to fully working prototypes. During these six weeks, the students positioned themselves in the theme by means of a transformative design vision in order to find their unique design challenges within a specific context. They went through several, hands-on iteration cycles to create and deepen their insight into the design challenge. Moreover, they used co-reflective techniques to validate their proposals in real-world settings with users.

The resulting six working prototypes each explore the 'Learning and Education' theme from different perspectives:

The 'Sense6' concept explores how the idea of learning through doing can be operationalised in the context of extreme sports. The concept provides real-time, non-obtrusive feedback on skateboarders' actions to improve their technique 'in the action'.

The 'Ennea' concept focuses on the social development of high school freshmen. The concept helps them adapt to their new situation during their first months of high school and provides input for the regular tutoring hours.

The 'StoryTail' concept analyzes socio-cultural learning in the home context. It provides an interactive platform for parents and children to create stories together in an intimate setting.

The 'Omeo' concept finds inspiration in learning from the lessons of life. It is a portable augmented-reality platform that offers the opportunity to annotate the physical world to trigger discussions between parent and child.

The 'Active Explorers' concept supports active exploration by children. It directs children away from the internet and into the real world to actively explore and learn from the richness to be found there.

The 'Curious Paths' concept revolves around tourism. It opens up the city environment for active exploration by means of GPS markers left by others with similar interests.

With pleasure and pride we invite the reader to enjoy six of our Eindhoven designs.

For an interactive presentation of the six Eindhoven designs please follow the link: https://w3.id.tue.nl/en/department/communication/eindhoven_designs/volume_one/

Bram Braat, Ivo De Boer, Laurens Boer, Joran Van Aart



Vision

Our vision originates from one of the pillars of the Department of Industrial Design, which is 'learning by doing'. What we want to express with this vision is that learning does not just mean developing cognitive skills. Learning also means the development of perceptual-motor skills – making your body learn certain skills. Think of learning to shoot a free kick in soccer,

Learning by doing		
	instruction	feedback on technique
coach/ personal trainer	different practices/ amount of practices	how well is exercise executed
no coach	own program/ program provided by instructor or professional	sensorial/ monitoring feedback

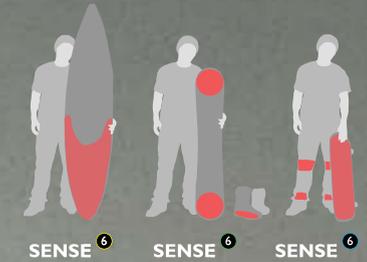
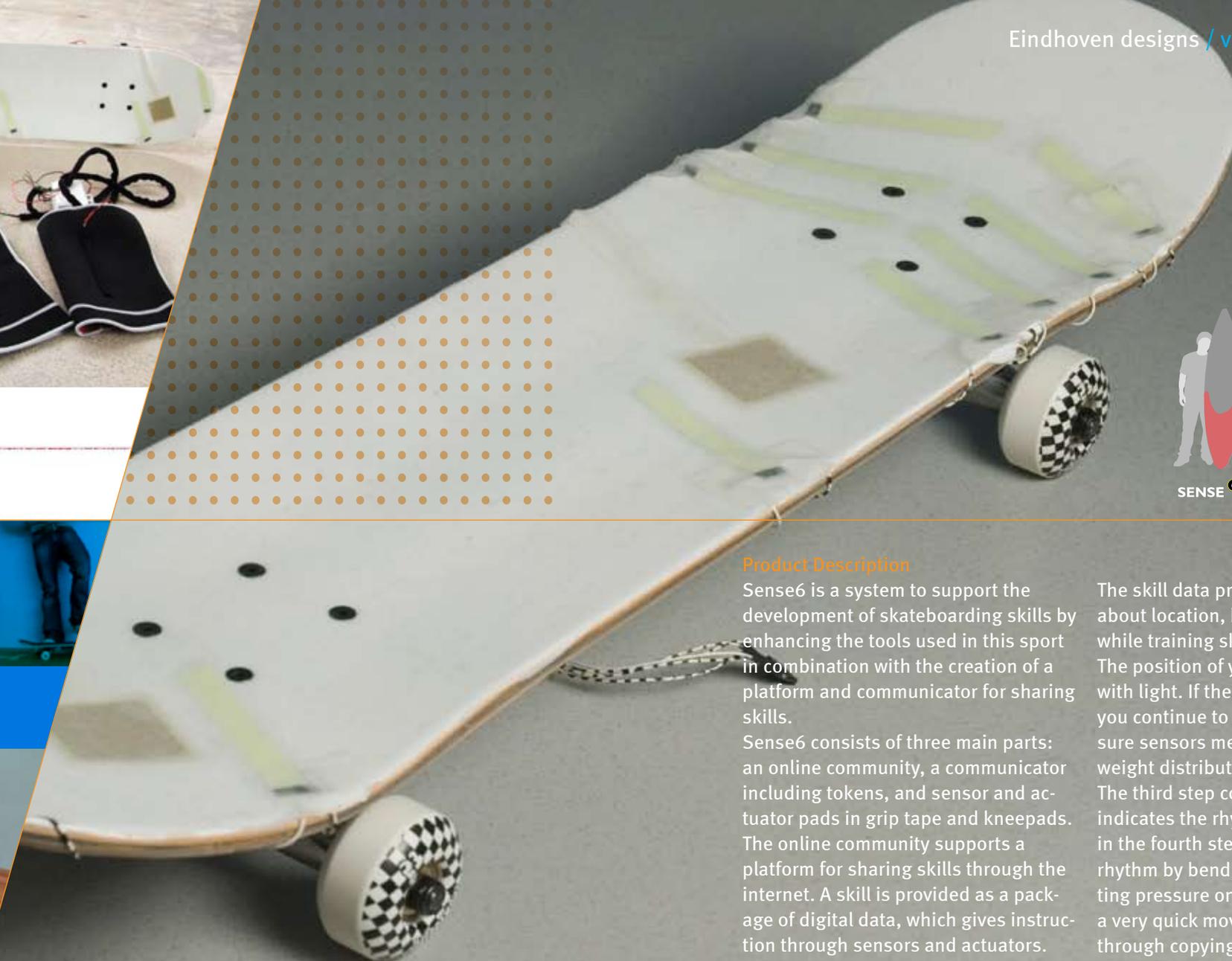
for example, or making a calligraphic painting. You train your body to make a certain movement.

We emphasized two characteristics in the development of bodily skills: bodily skills are developed either with a coach or without a coach and while you are developing bodily skills you need to get instructions or feedback on your technique.

With a coach present, you can get instructions on how to develop the skill, and while practicing the skill you can get feedback on your technique. Without a coach it is still possible to get instructions, for example on the internet or from an instructions-booklet. However, what you miss is feedback on your technique: you do not know if you are executing the instructions well. The latter area provides opportunities for this design competition.

What is missing in this area is the social component of learning from someone else. To implement this in our approach we envision the following design goals for ourselves:

- support people in learning physical skills
- provide means for sharing skills, let people learn from each other



Product Description

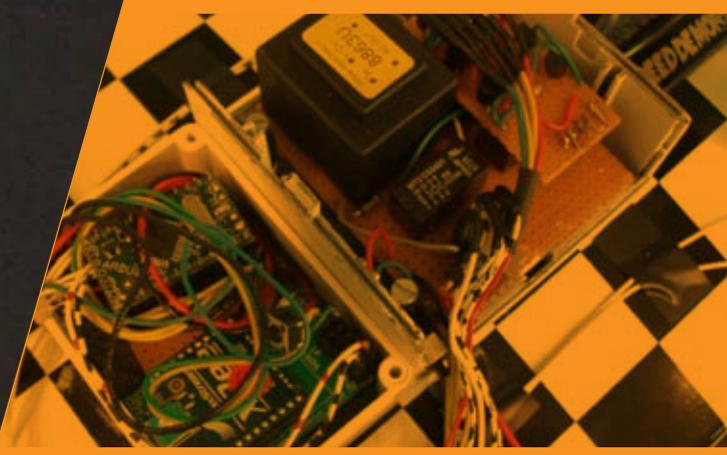
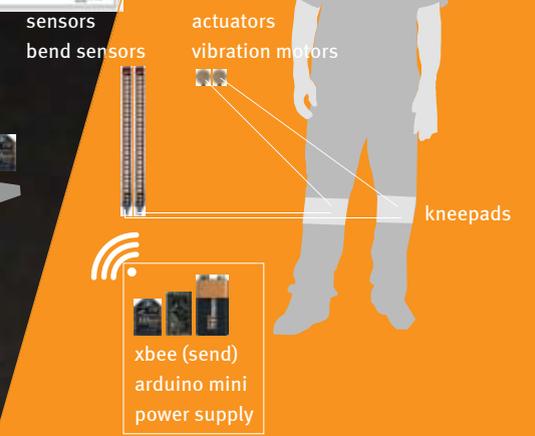
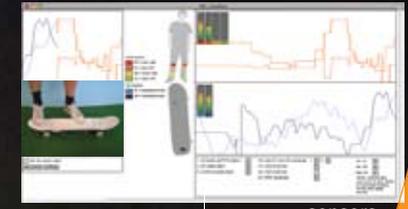
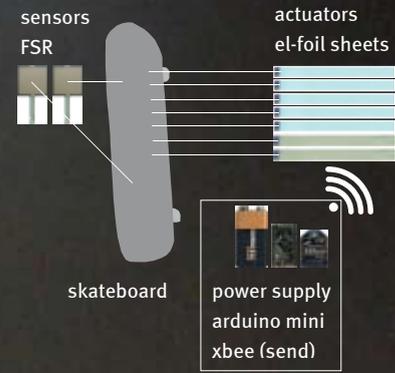
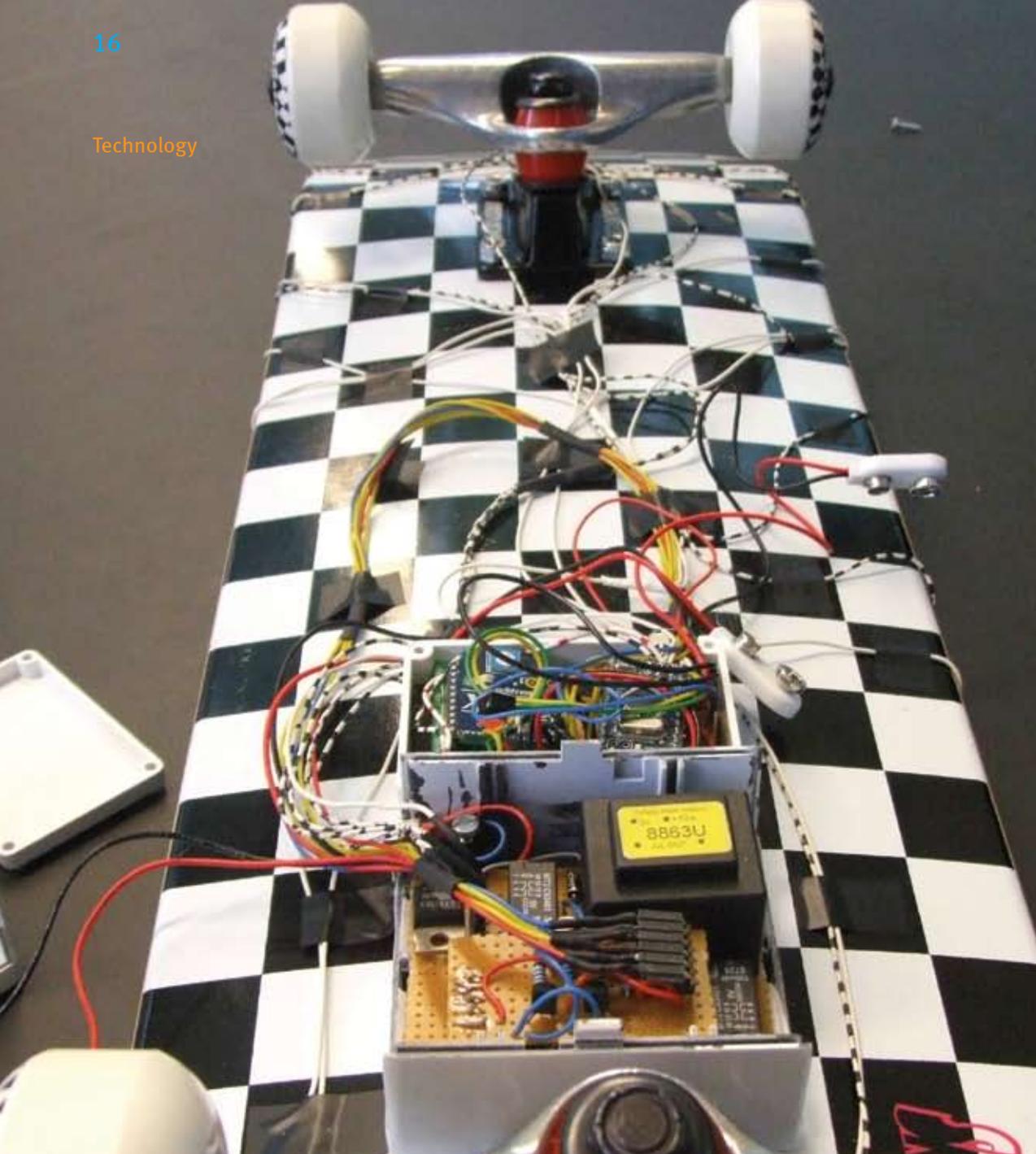
Sense6 is a system to support the development of skateboarding skills by enhancing the tools used in this sport in combination with the creation of a platform and communicator for sharing skills.

Sense6 consists of three main parts: an online community, a communicator including tokens, and sensor and actuator pads in grip tape and kneepads. The online community supports a platform for sharing skills through the internet. A skill is provided as a package of digital data, which gives instruction through sensors and actuators. This data can be downloaded through the communicator to a token, which contains the actual skill data. The same communicator can be attached to the board to communicate the skill data from the token to the sensors and actuators embedded in the grip tape on the board and to the sensors and actuators in kneepads. It also provides the board with power. Light indicators and pressure sensors are embedded in the grip tape and the kneepads contain bend sensors and vibrating actuators.

The skill data provides information about location, balance and rhythm while training skateboarding skills. The position of your feet is indicated with light. If the position is correct you continue to the next step. Pressure sensors measure and correct the weight distribution through vibration. The third step consists of a sound that indicates the rhythm you should copy in the fourth step. You can create a rhythm by bending your knees and putting pressure on the board. In this way, a very quick movement can be learned through copying.

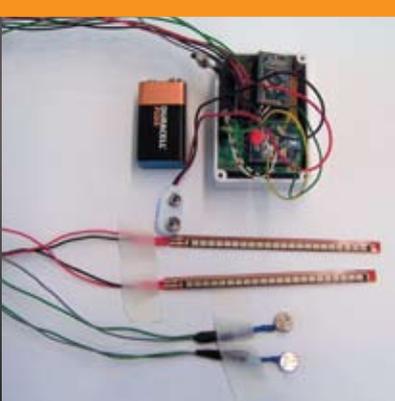
Sense6 not only helps you learn tricks, it also allows you to record tricks onto a token, which can then be uploaded and exchanged within the online community or in the physical world by connecting two communicators to each other and copying data from one token to another.

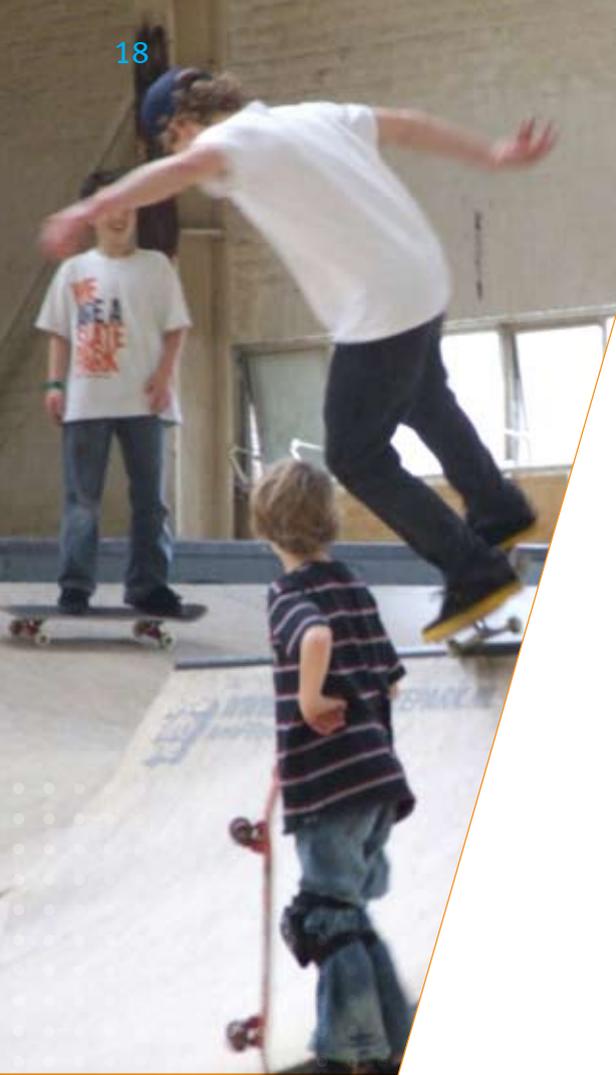
The Sense6 platform can be adapted for other sports, such as surfing snowboarding, by simply adjusting the sensor and actuator pads.



Above:
 Arduino, Xbee and Circuits for Pressure sensors.
 and ElectroLuminiscent Foil.

Below, from left to right:
 SoftPot Touchslider,
 Wires for driving leds in the interaction prototype,
 Arduino, Xbee, Bend Sensors and Vibration Motors for into the kneepads.





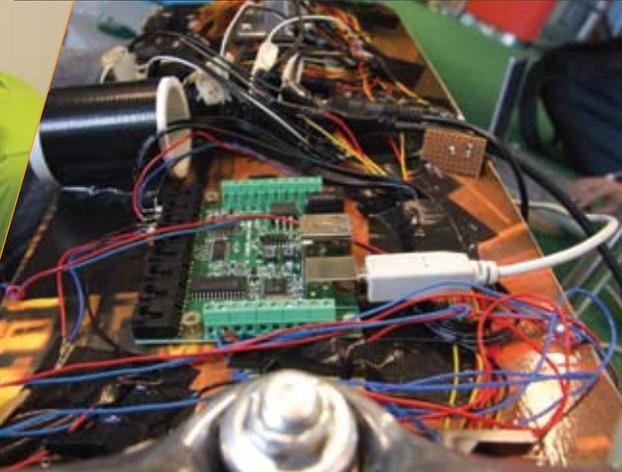
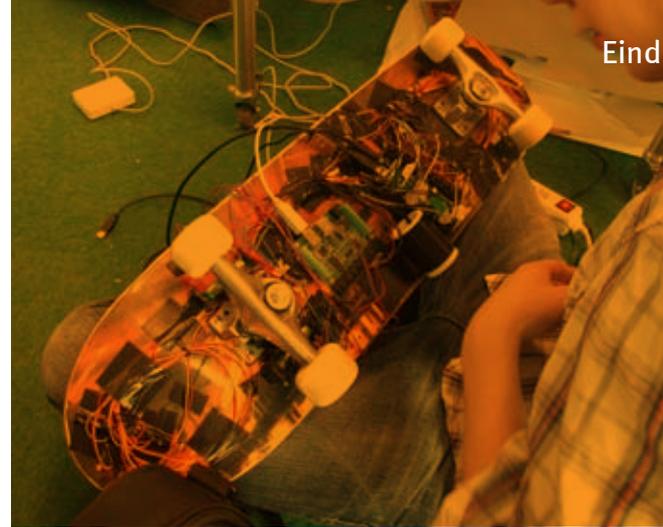
User confrontation

Amateur skaters have been involved in the project through a series of visits to Area 51, a renowned local skate park. In the early stages of the project, the opportunities were explored through observations and interviews. This provided insights into skating materials, trick learning and the social behavior of skaters. The repetitive nature of trick learning and the high level of cooperation were remarkable.

For the ideation, special attention was paid to the instructions skaters give each other when learning a new trick: foot position, balance and action sequence proved to be important features. This information was used in the selection of the type of sensors and actuators.

Explaining the Sense6 concept to the skaters mainly led to enthusiastic reactions and stories about how skateboards were already being modified. In addition, skaters emphasized the importance of a cool appearance in addition to the main functionality of providing personal instructions.

Overall, the social nature of skating is underlined by the way skaters practice together, the fact that tricks are recorded and shared through the internet and the existence of instruction videos for all kinds of tricks. These insights and responses strengthened our belief in the Sense6 approach to skill learning.



Process in pictures



Ennea

Laurens Doesborgh, Sjors Eerens, Jabe Piter Faber, Jasper Dekker, Jan Gillesen



Vision

The transition between primary school and high school comes with many different changes for pupils. High school freshmen meet new people, make new friends, explore a new environment and cope with new responsibilities. In addition to the burden of lots of homework, pupils have to settle within the 'group' and develop themselves on a social level. To aid these pupils during this phase, each high school in the Netherlands has assigned class-tutors who discuss, support and guide pupils within the same class in the area of social development. However, tutors only have limited information about the social activities and behaviors of the pupils. The students themselves, of course, are the main source of information. During the weekly tutor sessions, discussions are held about general social issues as outlined in supportive reading material. However, as became

clear during several interviews with tutors, pupils rarely seem to share private problems and feelings with the tutor or with other pupils during these sessions.

To aid the pupils with their social development we wanted to design a product that combines the pupils' social contact with these tutor class sessions. We wanted to provide a platform to reflect upon real-life social data through exercises and to create a new way of interaction between pupils to stimulate social contact. This offers pupils an opportunity to explore and develop their own identity within the 'group' in a fun and social way based on real-life data instead of theoretical examples from a book. In addition, we offer the tutor information about social contact between pupils, which can be used to support and guide them through their first semester of high school.





Product Description

Ennea, which is Greek for nine and symbolizes a turning motion, is the result of our six-week design project. Ennea records real-life data by looking at social contact and interaction between pupils within a school environment. This is done with mobile-networked objects, which can be carried around by the pupils. The measured data is translated into one of nine easy-to-understand social roles which are represented in the shape of animal icons. The meaning of these icons and related social roles can be checked on a poster that can be hung in a tutor-classroom. Knowledge of social roles allows the pupils to reflect on and look back on their social contact during the last week. This reflection can be done within the tutor sessions. An online service is provided for the tutor, which allows him or her to keep track of the actual data from the pupils' social con-



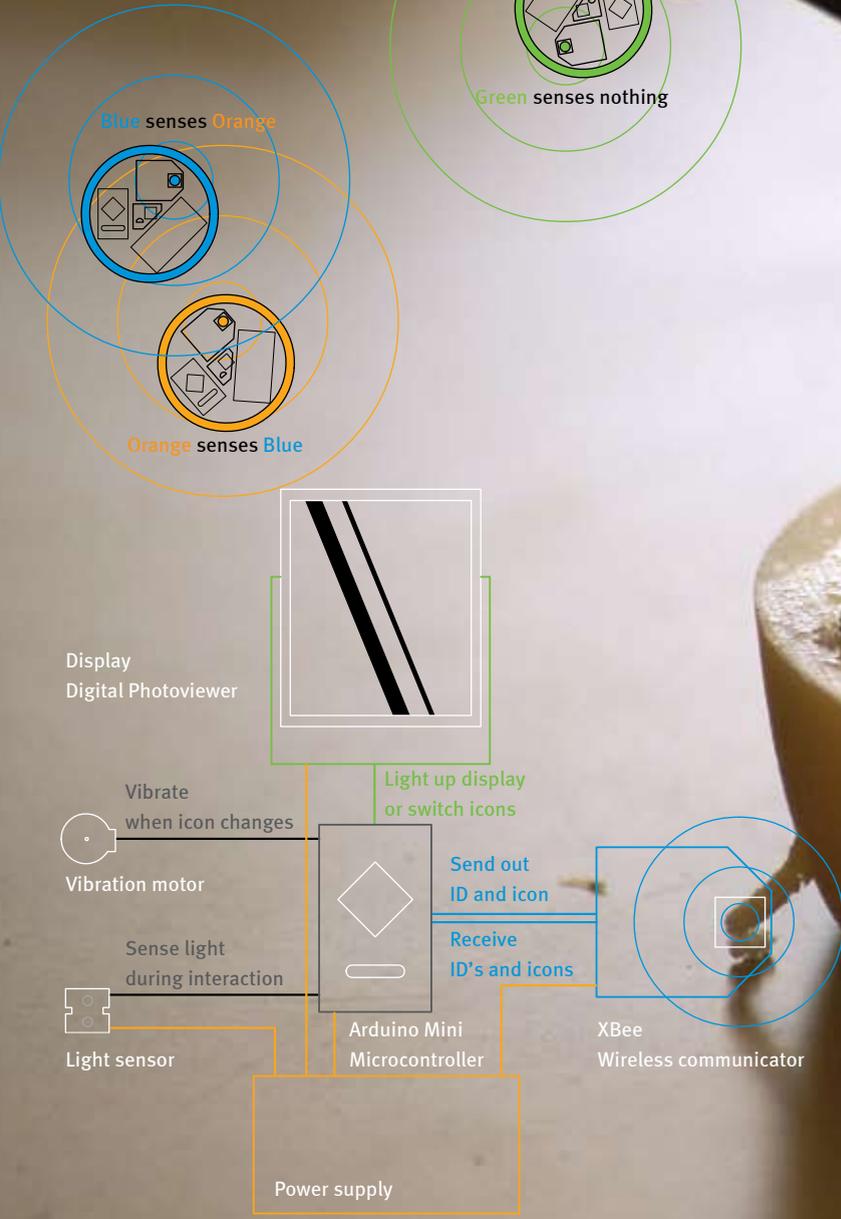
tact and the changes in the different social roles within the group. All pupils get an Ennea that they can carry around in their bag or pocket. Before and after school, in between classes and during breaks social contact is measured by the relative distance between the Ennea's. Pupils are 'socially connected' when they cross a social boundary by invading each other's personal space. By measuring the duration of social contact (intensity) and the number of pupils involved (diversity), the nine social roles can be mapped. Each animal icon has its own strengths and weaknesses so there is no good or bad role. According to the increase of intensity and diversity, the social role will change. To indicate the change, the Ennea will vibrate but will not yet show the icon on its display. The pupils need each other to visualize their social role.

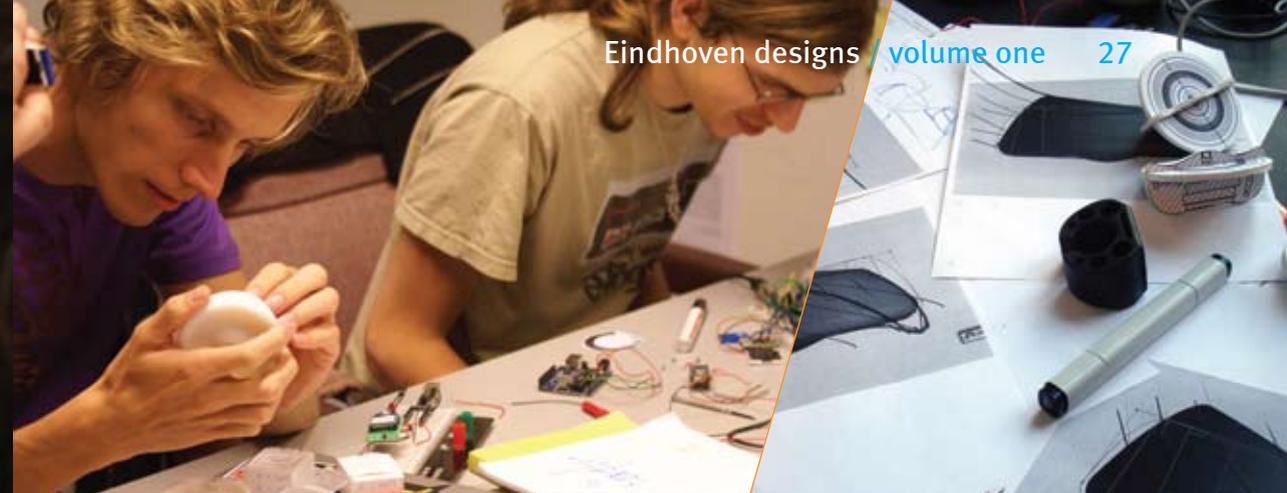
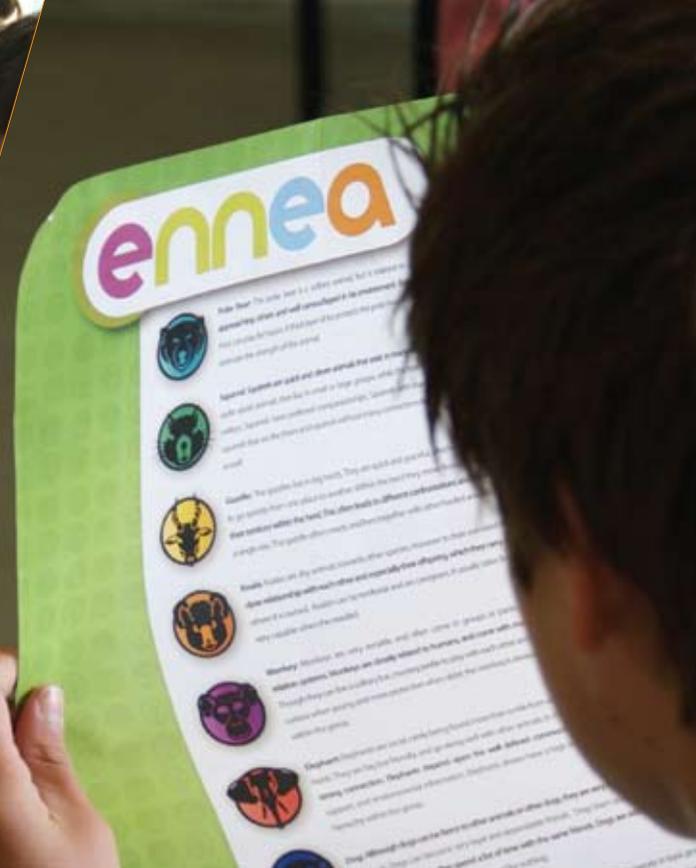
By moving and rotating two Ennea's close to each other, students can 'unlock' their icon. The icon appears for a short period of time when both Ennea's are in the right position, which allows the pupils to either share their roles with one another or keep them to themselves. The fact that the students can only 'unlock' their icons together stimulates interaction. When pupils become aware of their social roles, they can discuss their roles with friends, individually but also in class during the tutor hour. For more discussion or supporting information, the tutor can review the social contact of the group and its development by browsing the online service provided. These two elements provide valuable content for reflection and discussion based on real-life information about the experiences of the pupils themselves.

ennea



Technology





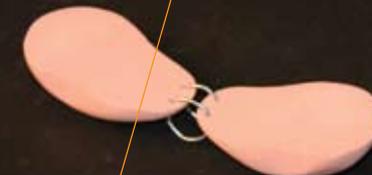
Process in pictures

User Confrontation

During the design process, we consulted high school freshmen and their tutors for ideas, inspiration and validation. After creating a vision, several concept ideas were combined into one concept direction that mainly consisted of a reflection tool/platform to stimulate social development by measuring the intensity and diversity of social contact between pupils. To gain insight into the problems and opportunities regarding the transition between primary school and high school, we not only consulted several tutors but also performed a co-design session with high school freshmen. We started by creating impressions of their social behavior and development and continued with an inspiring design session which eventually led to several requirements and the idea to expand the focus to include both pupil and tutor. The session indicated that

we needed to look for a playful but not competitive awareness-enhancing idea for the pupils, in addition to offering the tutor highly valuable and more detailed information about the pupils' social behavior.

After building the four working prototypes a second confrontation was scheduled during which we tested the interaction between pupils with the Ennea. Whereas the overall shape and interaction of the product was rated positively, the interaction between pupils still needed some improvement, especially the 'unlocking' of the icons. The intended metaphor of 'unlocking through exploration' was not sufficiently reflected in the product's form. During this final confrontation, a scenario was filmed to indicate the use and functions of the product as well as the initial reactions of both pupils and tutors.



StoryTail

Wouter Kersteman, Lissa Kooijman, Remco Magielse, Jaap Knoester, Floor Mattheijssen



Vision

Many children are exposed to unfiltered (media) content, be it on the internet or on television, in advertisements or in games. Parents cannot always be around to filter this content and to tell the children what is real and what is not and what is good and what is not. Therefore, it is important that parents teach their children values.

Storytelling is a great opportunity for parents to teach their children values. Since the content of a story is not pre-defined, both parents and children can add elements that they think are important to the story, thus creating their own 'customized' content. This content might be based on own experiences or on fantasy situations.

Since stories are told in a playful and intimate atmosphere, making the threshold for sharing personal experiences relatively low. By actively involving the child in the choices that are made in the story, the parent can get a sense of the child's values.

Storytelling is also a great way to teach children language skills and it stimulates the use of fantasy.

We want to enhance the playful exchange of values between parent and child by designing a product that helps and inspires parents and children to collaboratively create their own stories.





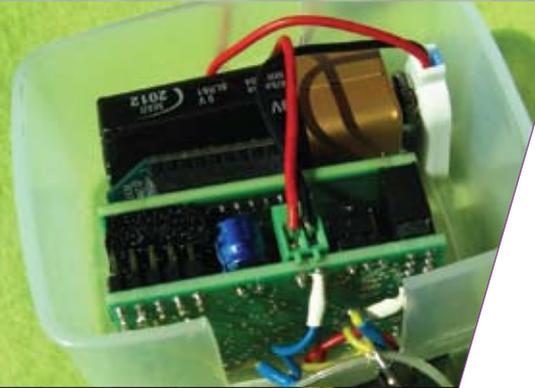
Product Description

StoryTail is a product that supports parent and child in creating a story together. The different elements of the story will determine the content of the story. The main elements of a story are a timeline, locations, characters and 'things that happen'. Prior to, or during, the story the parent and child collaboratively select the elements. StoryTail provides these elements and can be sold in toy stores in the following composition:

- A storyline, which is an empty canvas on which to place the locations and characters. The storyline can be used as a timeline, with a beginning and an end. It is flexible, long and soft, which makes it easy to be wrapped around the parent and child, or to be placed on their laps to create an intimate atmosphere.
- Six different locations where the story takes place, these locations will vary from very realistic to more fantasy-like.
- Four abstract characters, with various characteristics. The characters are based on animals. Even very young children have many associations with animals, such as their behavior or their habitat.



Combining different locations with different characters results in unique sounds. These sounds are specific to both the character and the location. This will inspire parent and child to come up with a story. When the story is finished, the characters, storyline and locations are all combined, showing the outline of the story. In this way, the child can reflect on the story, as well as on the values interwoven in the story. StoryTail is designed for children from three to six years old and for the persons telling the children stories, usually the parents. The product is meant to be used in a bedroom context, just before the child goes to sleep.



Technology

Prototype: A working prototype was made to experience and evaluate the concept. The choice was made to create three locations and two animals. This way it would be possible to show and test the full capabilities of the concept.

Electronics: All locations are equipped with several hot-spots containing RFID-tokens. Each character is equipped with an RFID-reader connected to a microcontroller. When a character is placed in the vicinity (a distance of about 5 cm) of a 'hotspot', the microcontroller reads the RFID-token from the location and adds a unique identifier for the character. This unique code is communicated wirelessly (using XBee) to a computer. In the computer, a database is stored containing several sound-files for each combination of character and 'hotspot'. The computer will play one of these sound files randomly, through the speakers mounted in StoryTail.

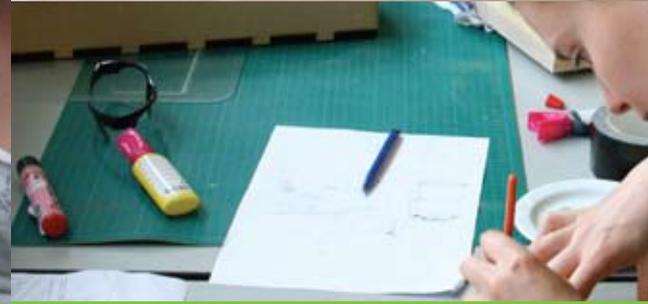
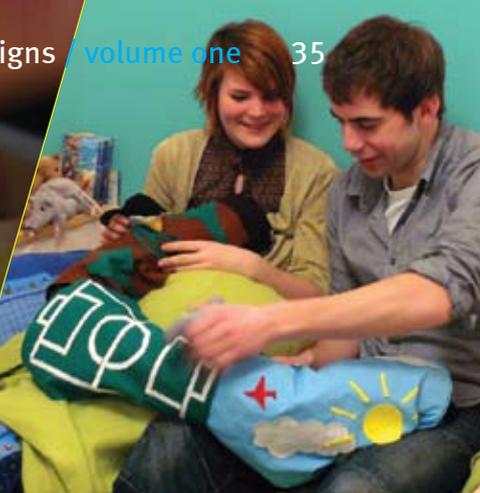
Construction: StoryTail consists of three layers of material. The inner layer of StoryTail is made of polyurethane. This layer gives StoryTail a firm, but flexible feeling. Two speakers are integrated in this layer. On top of this, a layer of cotton wool is added and the product is finished with a layer of fabric.

The locations are created from a layer of cotton wool wrapped in a layer of fabric. The RFID tokens are stitched in between these layers. The graphics are painted on top with fabric paint.

Previous page, from top to bottom:
RFID tag integrated in worlds/locations,
Integrated speakers in storyline,
Capsule with RFID reader and
Microcontroller located in the characters,
Hotspot.

Below:
Technology flow chart.





Process in pictures

User Confrontation

We did a user confrontation to validate the working prototype. We wanted to gain insight into the working of the concept and the users' experiences with the prototype.

The user confrontation was preceded by a pilot test, which was done with a six-year-old girl and one of the members of the design team.

We did the actual user confrontation with a father and his four-year-old son. In general, they had a positive experience and many stories were told. We made the following observations:

The form and soft materials of the tail created a common focus and an intimate atmosphere. The tail was not used as a storyline, as we intended, but more as a carrier for the locations. The child asked: "Are there more locations?" It is interesting to create multiple locations and sounds, which might add more dynamics to the story. The furry animals were used as the main characters of the story and to explore the situations this character encountered in a certain location. The sounds that were created did trigger creativity and surprising directions in the story. The story was told in interaction between child and father.



From top, counterclockwise:
parent and child collaboratively creating a story,
pilot test for the user confrontation,
child plays the story again.

Omeo

Bart Smit, Carl Megens, David Menting, Emar Vegt, Milou Pikaart



fun, serious and intimate memories, children will be more likely to browse and organize their digital triggers. Reviewing them is enough to get their mind flowing and to start reflecting on what happened. In this process, the child learns from the parent, and the parent can learn from the child.



Vision

Children aged six to twelve learn at least as much outside the classroom as they do inside it. Outside the classroom, they are confronted with all kinds of life lessons on how to deal with everyday situations and unusual experiences.

One of the key elements of learning is reflecting on what happened; being faced with memories, talking and putting them into context at different moments in life. This helps you understand events and learn from them. It helps when child and parent deal with such life lessons together. Items that trigger memories, such as pictures and movies, play an important role when remembering and reflecting. Omeo allows children to deal with these triggers in the physical world. By creating an easy and playful access to





Product Description

Omeo is a device that evokes reflection and discussion of memories by linking digital memory triggers to physical artifacts in the real world. With the help of Omeo children and parents can share experiences and memories.

This stimulates the child to learn about life lessons outside the classroom and helps parents and children to discuss these life lessons in a playful way.

The digital memory triggers used by Omeo are multimedia files.

Omeo detects nearby recording and capturing devices, such as mobile phones and cameras, and indicates that there is content available by showing bubbles above the device.

The child can pull out the virtual

content by pointing at the device with Omeo and shaking it up and down.

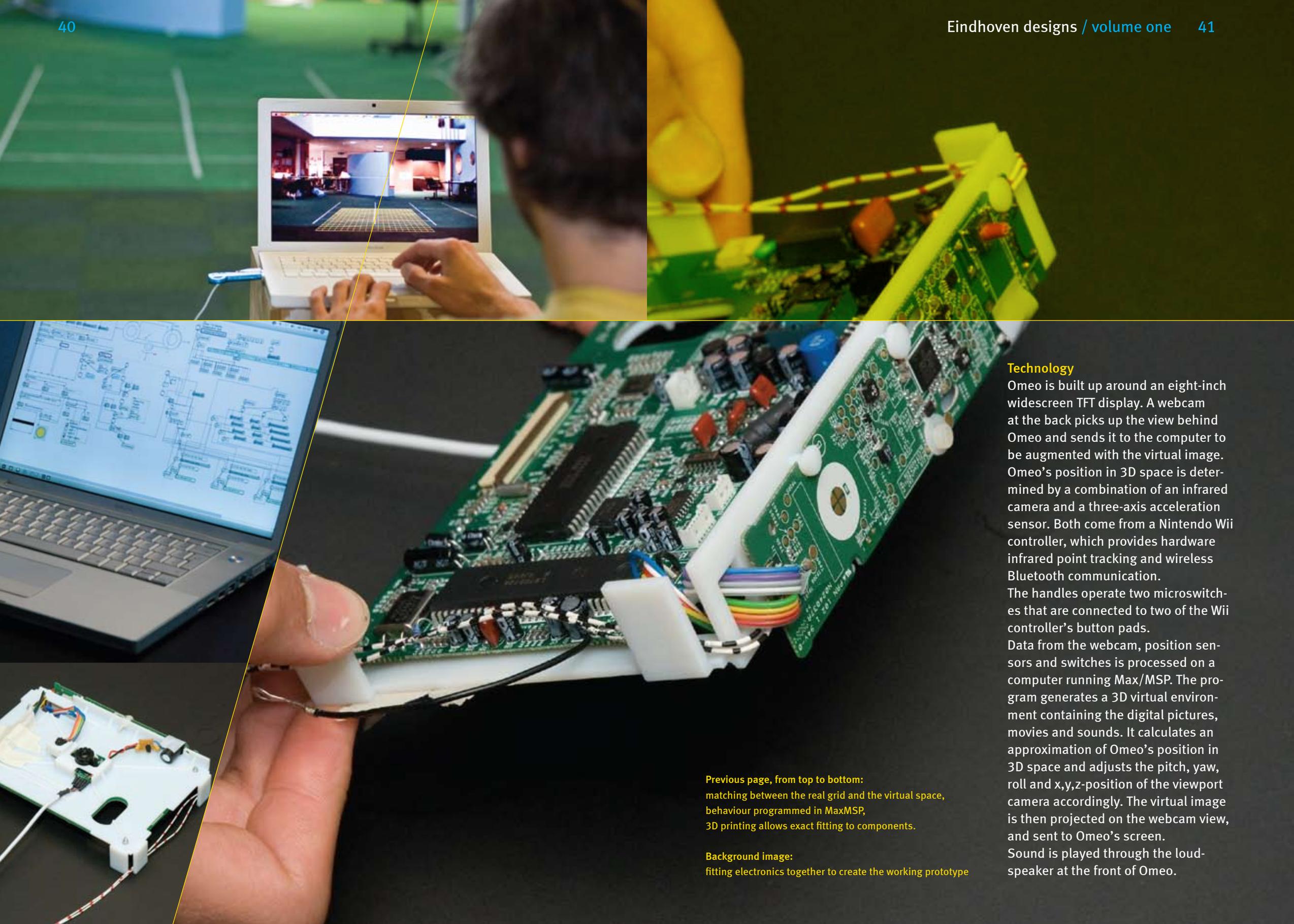
By moving Omeo around, children and their parents can browse the content and select a digital memory that they want to attach to a physical artifact.

Positioning the digital memories can be done by grabbing a digital memory with Omeo's round handles and releasing this memory again when it is in the right position.

Using Omeo the child and parent can go through their home which is full of physical and digital memories that are linked to each other.

These memories help children to reflect on what happened and learn about their lives.





Technology

Omeo is built up around an eight-inch widescreen TFT display. A webcam at the back picks up the view behind Omeo and sends it to the computer to be augmented with the virtual image. Omeo's position in 3D space is determined by a combination of an infrared camera and a three-axis acceleration sensor. Both come from a Nintendo Wii controller, which provides hardware infrared point tracking and wireless Bluetooth communication.

The handles operate two microswitches that are connected to two of the Wii controller's button pads.

Data from the webcam, position sensors and switches is processed on a computer running Max/MSP. The program generates a 3D virtual environment containing the digital pictures, movies and sounds. It calculates an approximation of Omeo's position in 3D space and adjusts the pitch, yaw, roll and x,y,z-position of the viewport camera accordingly. The virtual image is then projected on the webcam view, and sent to Omeo's screen.

Sound is played through the loudspeaker at the front of Omeo.

Previous page, from top to bottom:
 matching between the real grid and the virtual space,
 behaviour programmed in MaxMSP,
 3D printing allows exact fitting to components.

Background image:
 fitting electronics together to create the working prototype

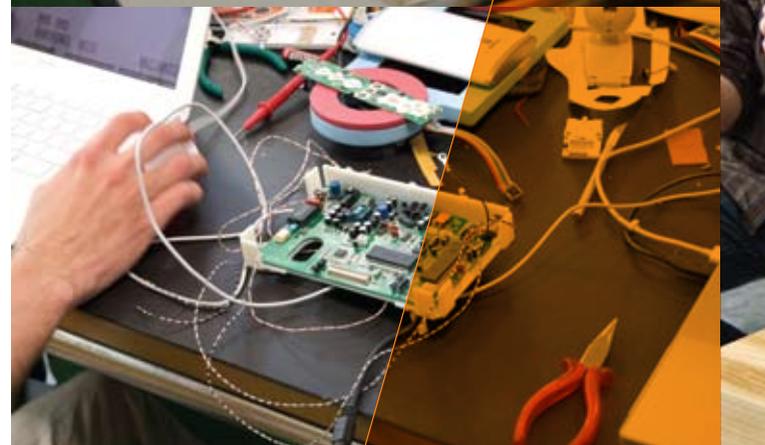


User confrontation

Developing a product that evokes reflection and discussion of memories requires a good understanding of these concepts. In order to get a feeling for how children and parents deal with memories, we visited several families and interviewed them in their homes. We wanted to see the similarities and differences between children and parents in how they remember things and in what they remember.

The children were asked to take pictures of things that they found important in their house. The pictures were discussed, focusing on how the artifacts and pictures they photographed help them revive memories. We asked both parents and children to talk about what they remembered of yesterday, the past week, a month ago, a year ago and before that. We found out that it is difficult for children to remember what happened when, especially if they have no hooks such as photos or physical artifacts. Having these triggers around, helps them relive and reflect on memories more easily.

Process in pictures



From top to bottom, counterclockwise: child shows a specific special item and remembers the linked event, children drawing their memories from 1 day to 1 year ago, photo made by one of the interviewed children of a memory different physical reminders collected together



Active Explorers

Rick van de Westelaken, Arne Wessels, Jurgen Westerhoff, Jing Wang



photo by Alex Carmichael

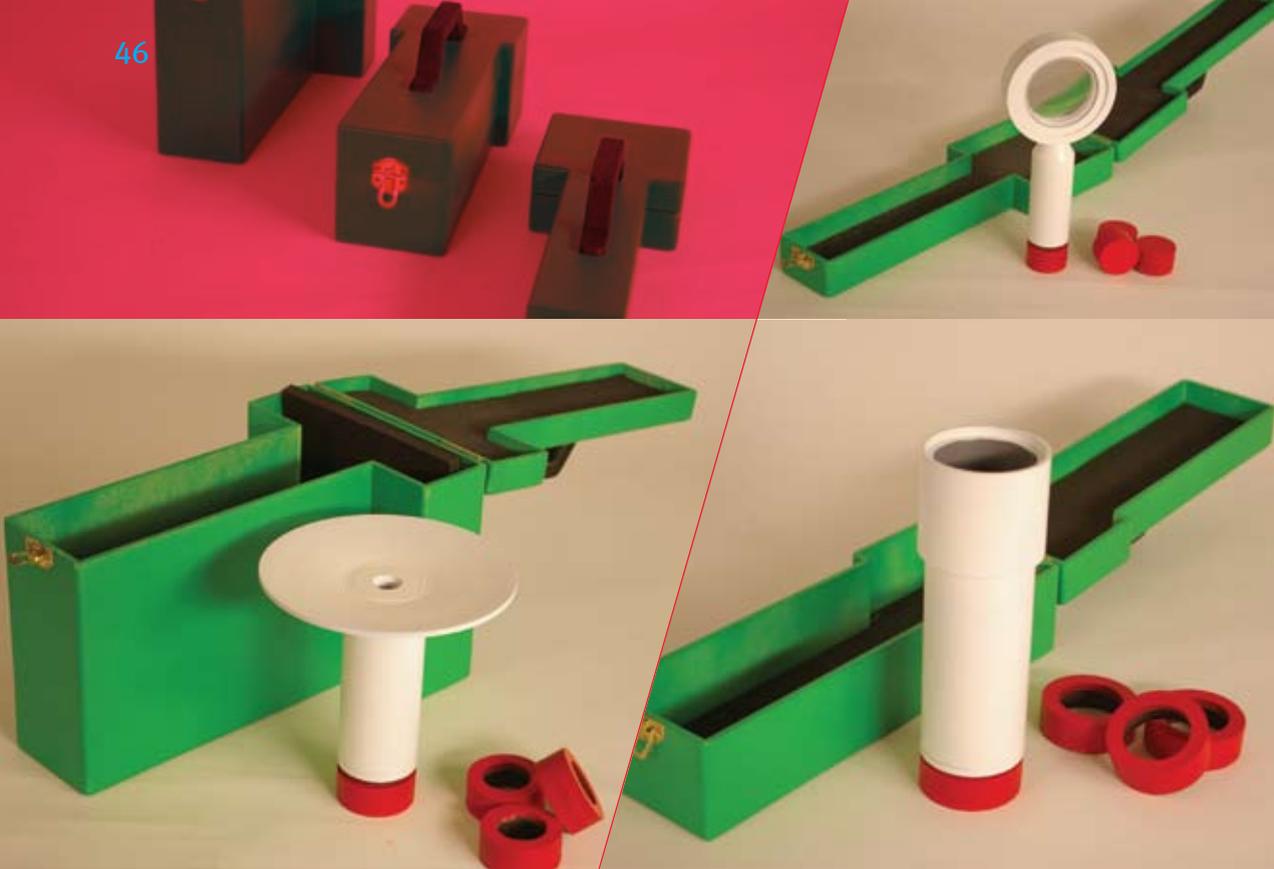
Vision

Recently, there has been a shift in the way children are educated. In the conventional educational style a teacher is considered to be the person who knows everything and children are supposed to simply accept everything they are told. In the new educational style children are challenged to discover knowledge and find connections between facts through their own investigations.

We believe in this 'new style' of education and therefore want to support it by stimulating children's active curiosity and let them 'learn by doing'. Children should explore and understand the world around them by making discoveries on their own. These explorations should take place in the real world instead of on the internet.

We want to make a product that stimulates children to search for answers and makes them understand what they observe by letting them reflect on it in an unconscious manner.





Product Description

In the classroom the teacher provides a certain theme or question to a group of (four) children.

With the Active Explorers Set the group is stimulated to explore the theme from different perspectives. Four tools can be used to collect samples. Each of these tools has a distinct form and use. One device captures audio, another video (no sound), the third can be used to make close-up photos and the fourth to collect haptic or smell samples. Each device has its own travel box and a number of corresponding data carriers, each for one recording.

The devices start recording when the data carrier, a red ring, is pressed.



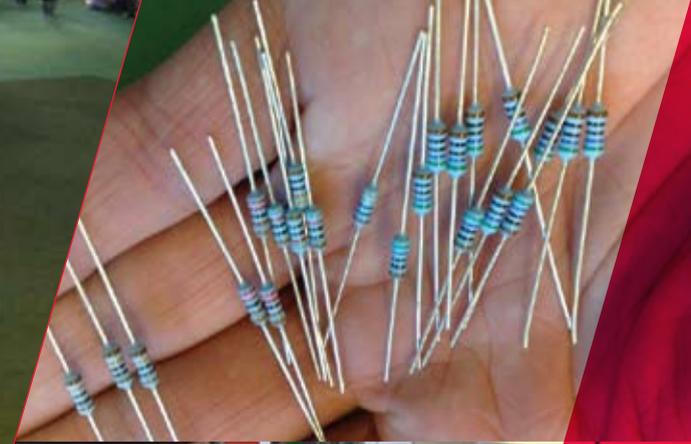
To record audio, for example, place the device on your ear and push softly until it clicks.

The recording starts and it stops when you take the device off your ear. The recorded sample rings can be stored and reviewed in the central presentation box. By placing the rings on the circular readers, the content is played back, video and photos on the screen and audio through the speakers. Because the devices do not have an integrated review function, the children are forced to review their recordings on the central box and discuss as a group whether it fits their intentions. When all the necessary capturing is

done, the central box with the loaded rings is given to another group of children. They can start experiencing the samples of the first group by using the interface in the box. Image and audio can be combined, the objects in the touch and smell boxes can be perceived in the intended way. Finally, together with the teacher the two groups can discuss the theme and the way it has been captured, so that they can reflect on their course of action and choices. This is an important learning moment for the children: Did they convey what they intended to and how was it perceived by the other group?

Technology

Since it was not possible to prototype the whole 'Active Explorers' toolkit in six weeks we chose to focus on prototyping the central presentation box. An important consideration for building the prototype was manageability of the prototyping process. To ensure a smooth operation of the prototype we chose to keep it as simple as possible. As a basis we chose to use an ordinary laptop, which stores the media content of the capture rings, handles microcontroller communication, and provides a video signal for the presentation box. The presentation box features a central fifteen-inch TFT screen and a means to identify the sample rings that 'carry' the media content. The rings are used as identifiers for content that is stored on the laptop. They are identified by each using a different resistor. The values of the resistors are read by means of an Arduino microcontroller which sends the identifier to the stored content over a serial protocol. The laptop visualizes the media content on the screen of the presentation box. Thus, we created a very simple way of identifying different objects and displaying its content.





Process in pictures

User confrontation

During this project, we did a confrontation with potential users to validate our design. In our first user confrontation we explored to what extent our design decisions resulted in a concept that is capable of changing the behavior of children. We did this by comparing the children's behavior using conventional methods and their behavior using our physical prototypes. This user confrontation was not meant to test the actual functioning of our prototypes but rather to gain an overview of the richness in collecting data using different media and in the children's level of inquisitiveness. The user test provided us with information for further development of our concept and gave us validation for the

design vision. Analyzing the results, we drew conclusions for further design decisions. These conclusions were related to three aspects. First of all the physical prototypes proved to give more focus to the tasks than conventional methods. An unlimited amount of media storage space limits the children's judgment of the quality of captured data. Constraining the amount of media storage possibly stimulates their decision making process. Secondly, the approach of their exploration should be pre-defined in a focused plan. Cooperation should, however, be allowed and encouraged. And thirdly, the devices should be fun, appealing, and engaging to persuade active usage.



Curious paths

Tom Van Bergen & Tom Frissen



Vision

While exploring many different possibilities within the theme of 'Learning and Education' we were inspired by the fact that there is so much knowledge among people and in the world around us. Most of this knowledge we are not aware of although it might enable many opportunities for learning and education experiences. Thinking of ways other people could help us find this knowledge, we saw many opportunities in using curiosity as a trigger. Making people interested through curiosity would elicit an exploration of the environment and thus create opportunities for learning experiences. This vision evolved during the project based on new insights gained by the creation of experimental prototypes, the analysis of new possibilities and user validation. This is also what the reflective and transformative design process is intended for. In our final vision, we integrated a target group and context and presented it as follows:

We want to make people curious about specific (hidden) locations in a city environment, marked by other people. This curiosity will lead to an exploration of the environment, creating opportunities for learning experiences.



This vision not only states that you will learn from the location you are going to, but that you will also learn while exploring the environment. We chose tourists as our target group, since they are naturally more explorative in their behavior and want to learn about the place they are visiting. The context is a city environment, because cities contain many locations that appeal to a large variety of people with different interests.

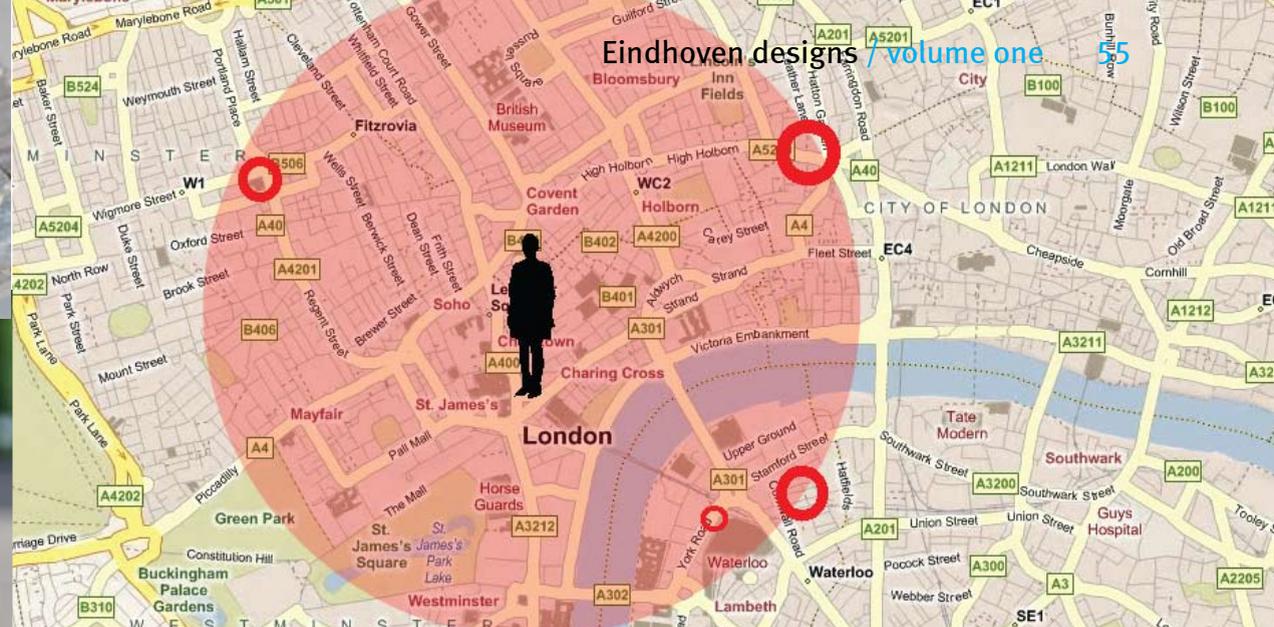




Product Description

Curious Paths is a system designed to make people curious about specific (hidden) locations in a city environment. Provoking curiosity was one of the biggest challenges in our project since curiosity was the key to enabling learning experiences. In our concept, we trigger the user's curiosity through a mysterious black device, which fits in your hand and guides you to locations in a city environment, which meet your personal interests. The user needs to create a personal profile describing personal information, hobbies and interests. A software application links this user profile to other people with a (somewhat) similar profile and thus creates a network with people from all over the world. The locations these

people have visited will probably be of interest to the user too and are uploaded to the device, together with a value, which describes the match between the user and the person who has visited that location. Once synchronized, the device can be used to find locations in city environments. Orienting yourself in 360 degrees enables you to feel directions to locations, which are no more than one kilometer away, through a vibration pattern. Differences in vibration patterns provide a clue about the location. The distance to a location determines the vibration frequency and the match value determines the strength of the vibration. The vibration patterns trigger the user's curiosity and the user can choose which location to navigate to.



visualization of locations which can be found in a 1 km radius



Focusing on a location

Navigating to a location is made easy by focusing on a location. By sliding a finger through the cavity the user focuses on one location. Lights in the device now change, indicating the user's focused status. The user only feels the direction he focused on. Walking in the direction of the vibration will guide the user to the location, but because the device only gives a direction, the user is forced to look at the environment and find his own route through the city. Looking at the environment and finding a way through it immediately enables learning. While navigating to a location, the vibration frequency builds, indicating that you are getting closer to the location. Once you are in within five meter from

the location, the device will vibrate continuously, indicating that you have arrived. Storing a location can be done by pressing the device. Pressing starts a vibration pattern, which rapidly builds in frequency. Once the vibration has stopped, the GPS locations are stored so that they can later be shared with other people. Finally, we enable post-visiting, enabling you to review your visited locations by using the software application again. Synchronizing the device uploads all locations the user has visited and displays them on a map. The user is now able to learn more about the visited locations by reading information other people have added. The user is also able to add his own information to the locations that he visited.

Technology

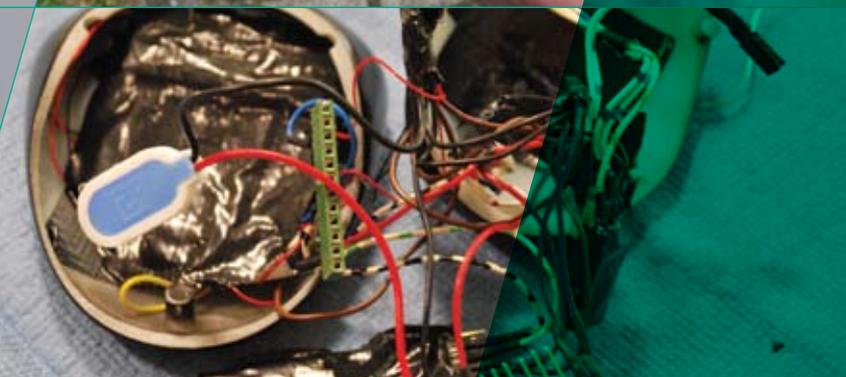
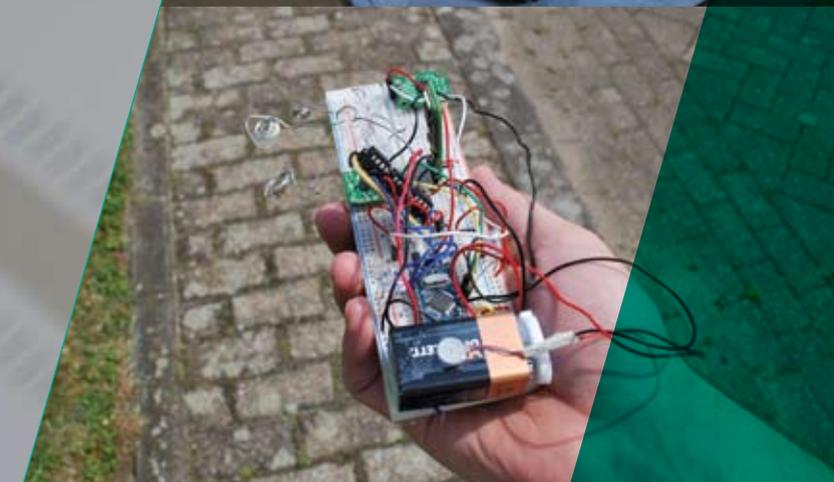
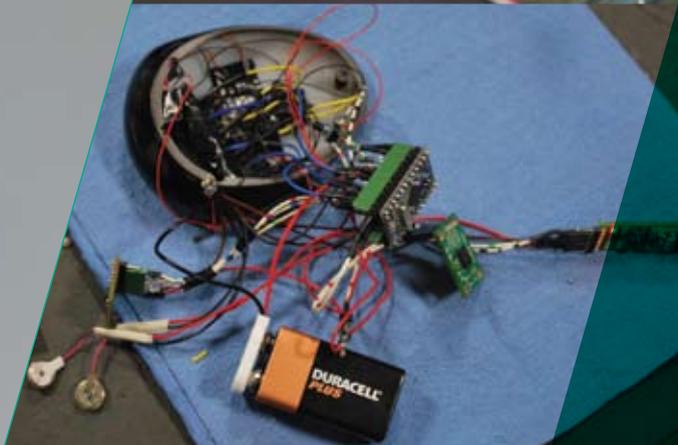
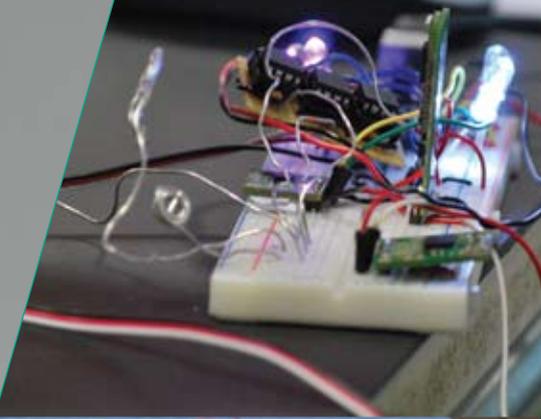
We created a working prototype for our concept. This prototype uses GPS to determine its position, a digital compass to read the directions the user is pointing to, a three-axis accelerometer to measure the holding position, capacitive touch sensors for focusing, Bluetooth for a wireless computer connection, an Arduino mini to process all input data and finally LEDs and vibration motors as outputs for user feedback.

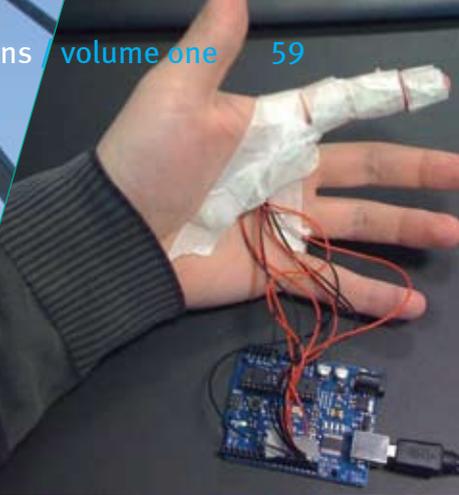
The model communicates with a computer which processes the compass data and calculates headings and distances to locations by a Bluetooth GPS receiver.

Data is sent back and forth between computer and model, enabling a real-time working prototype which can be experienced in the context for which it is designed.

```
void printData(int bearing) {
  Serial.print("bearing: ");
  Serial.print(bearing/10);
  Serial.println(" degrees");
  delay(100);
}
```

```
void analyzeBearing() {
  // analyze bearing
  // the bearing degree
  // (bearing/10) > 1 && (bearing/10) < 50 {
  digitalWrite(ledPin, 255);
  digitalWrite(ledPin2, 255);
  delay(40);
  digitalWrite(ledPin, 0);
  digitalWrite(ledPin2, 0);
  delay(40);
}
```





Process in pictures

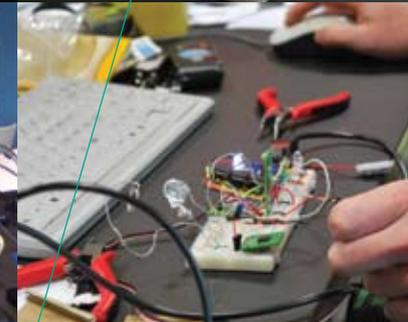
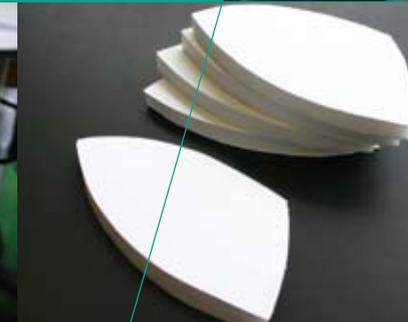
User confrontation

Insight in the design context is essential in a good design process. That is why we started with a visit to a city we did not know. This put us in the tourist's shoes and made us gain useful insight which helped us develop our concept further.

Even more insight was gained through a user-involvement session. In the first exploration part of this session, we interviewed two potential users, who did not know what our concept was about, and asked them about their previous experiences when visiting a city. This first part provided insight into what elements of visiting a city are important to users and what kind of information is used to make decisions about what and to do in a city.

The second part was about ideation and in this part we asked the users to describe improvements to their previous experiences and what these improvements might look like or how they might be achieved. We hereby focused on the discovery of interesting places in a city.

In the third part, we confronted the users with our concept and asked them to describe possibilities and pitfalls, based on their previous stories. A final step in our user involvement was a contextual confrontation. We explained the concept to two different users and asked them to create interactions they thought applied to finding interesting locations, navigating to these locations and storing a location.



In conclusion: hard work and fun

Designing should be fun. The Department of Industrial Design at TU/e focuses on the design of intelligent systems, products and related services. But we want more. We want to create a 'better' world by educating students in a 'better' way. With this we not only mean that our students should master the integration of technical sciences and the humanities through design, in their vision. We also mean that by doing so, they become more human. Our educational process helps us reach these two goals. It is powered exclusively by projects and builds students' integrative competencies by evoking reflection on action in a relevant societal context. The Microsoft 'Learning and Education' project fits this view perfectly.



The drinks after the presentations were well-deserved. The students and coaches had been working hard for six weeks spread out over the semester in blocks of two weeks. The result was six visions on 'Learning and Education' physicalized in a set of six working prototypes. I for one was flabbergasted. What strikes me on these occasions is the enthusiasm of students and staff alike and the happiness and profound satisfaction after a job well done. I would like to thank the students who worked on these projects. We ask a

great deal of you, maybe too much at times. Believe me, we are cruel to be kind. Now that you have the energy, the motivation and the skills, we offer you a podium and want you to perform. And we do not go for second best. I want to express my deepest appreciation and respect for what you achieved in six weeks. The presentation jury was impressed, and quite rightly so. I am convinced I speak for all members of the 'Designing for Quality in Interaction' team. It is such pleasure working with and for you.

I want to thank Microsoft for offering us this opportunity. Presenting us with an international podium on which we can compete with internationally renowned design schools is the ideal instrument to push our students to the limit. Thanks to Sander Vieggers, our enthusiastic Microsoft contact person. I want to thank the jury who took on the difficult task of evaluating the six teams. The jury consisted of Jeu Schouten our Dean, Emile Aarts, professor at TU/e and CEO at Philips Research, Caroline Hummels, our Education Director, Richard Appleby, our Masters' Design Director, Lucian Reindl, a Masters' coach and owner of a design office in Cologne, and last but not least Joep Frens, the animator of the 'Interaction Design Class' during which the project was completed.

Speaking of which, my special thanks and appreciation go to Joep Frens and Oscar Tomico. You did a great job. Thanks, Joep, for confronting our students with your professionalism, for your demanding character, and for always being in an excellent mood. Thanks, Oscar, for choosing rainy Eindhoven over sunny Barcelona, and for being who you are: a great design teacher and a diligent worker.

Kees Overbeek



