Scaffolding shared learning about sustainable futures between design engineering students, users, and a smart grid project team.

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Theme: Sustainability

Abstract

Like the professionals, design students tend to avoid the complexity of the user context, and moral issues are largely overlooked. This inspired us to explore whether we could engage design students in thinking about moral issues by exploring different ethical frameworks in their designing. As a case environment we chose smart-grid product-service combinations. In this paper we first discuss the ethical frameworks of four selected philosophers': Plato, Rousseau, Kant, & Mill. Then we will describe the student design process, the resulting four smart grid service concepts and the user insights that

came from a user evaluation. We discuss how this approach allowed the students to get insights in their own ethical stance and how they allowed users to reflect on possible futures. We also discuss how these 'probing' concepts were used within the larger smart grid project.

Introduction

In the past few years many products and applications have been developed that aim to either make people more conscious about their use of energy, or to reduce their energy usage. Think of apps on the smartphone, thermostats, small screens that show energy usage by means of CO2 production, kWh, or color oftentimes these products derive from the assumption that by providing users with information will make them change their energy consumption patterns. Some early products also facilitate 'actionability', the possibility to not only take in the information, but also support action.

These products focus on reducing energy use. However, with the massive increase of photovoltaic- energy production in combination with Wind turbines that are being installed in the near future in Western Europe, the question is going to be not so much 'how to make people use less energy', but how to use 'green' energy when it is available, basically tuning the usage of the energy demand to the availability.

We are partner in a government-funded project with ten partners from business and academia, called 'SmartGrids, Pay-off for Everyone'. This project aims to explore and develop new services and business models that can help make smart grids become reality in the Netherlands. The premise of this project was that –at the time of writing the proposal- most smart initiatives dealt with technical explorations and very few dealt with developing the business perspective. Some concepts of smart grid services- like home energy management systems were published, but hardly any have developed to a real-life solution tested in the real world. So that is what the project set out to do.
However, as many of the partners come from technology-driven backgrounds, the predominant paradigm remained to focus on automation of services and rejecting/ not

acknowledging the influence of the user to the systems. Questions like ‘how will people live with these services? and ‘how can we utilize the users’ intelligence in the systems?’ were hardly asked, let alone moral questions like ‘to what extent are we justified in forcing a certain kind of energy usage profile onto the user?

Like the professionals, design students tend to avoid the complexity of the user context, and moral issues are largely overlooked. There is some evidence that designers and (especially) engineering design students do not consider moral issues while designing. In an experiment by Lloyd et al (2005), student teams were given the assignment to develop concepts for a new toy gun for a toy company. The design brief mentioned that the more realistic a toy-weapon, the more children like it. Protocol analysis of the conversations while performing the design task showed that design students had very few discussions about the ethics of designing a realistic toy-gun for children. If any, these topics surfaced in the end of the experiment and were discarded easily. Argumentation was largely based on utilitarian thinking (see below): striving for the largest amount of gross happiness among people, so if a minority of people is shunned from the benefits, this is acceptable as long as the overall happiness increases. As this allows a designer to ‘calculate his way’ out of a moral dilemma, this is clearly a way of dealing with ethics that fit the engineer’s mindset. The engineering way to approach getting a grip on complex phenomena involves analytical modeling.

As another exploration of how ethics and design meet, Philip Ross (2008) explored the relationship between aesthetics and ethics in interaction design, by analyzing how designers interpret ethical frameworks from various philosophers and use these to design interactive products. For instance, he asked designers to design vending machines coming from a Nietschian and Confucian perspectives (see fig. 1). The Nietschian vending machine asked for a buyer who asserts himself by having to shout out loud while standing on a pedestal in order to receive a candy bar, while the Confucian vending machine required a lengthy and delicate process of positioning and re-positioning pins before a piece of candy would be provided.

Figure 1: Prototype's of candy vending machines. Left: Inspired by Nietschian ethics, Right: Inspired by Confucian ethics. (Ross, 2008).

This inspired us to explore whether we could engage design students in thinking about moral issues by exploring different ethical frameworks in their designing. As a case environment we chose smart-grid product-service combinations.

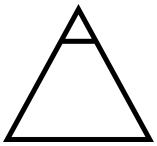
In this paper we will first discuss the selected philosophers' views, then we will describe the design process, the resulting four product-service concepts and the user insights that came from a user evaluation. We will also discuss how these 'probing' concepts were used within the larger smart grid project.

Ethics for dummies: four philosophers

In collaboration a graduate from the Philosophy Department of Utrecht University, we selected four ethical frameworks, that are actionable in the context of smart grids (suggesting possible pathways to solutions) and that provide substantial variation.

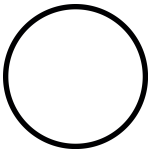
This led to four well-known philosophers that vary in the amount of individual responsibility and control: Plato, Rousseau, Mill, and Kant. We chose these philosophers because they reason with very different ethical frameworks. This ensured that the various student groups would explore a wide area of the design space. In addition, considering these different ethical viewpoints could enable them to develop their own ethical view.

As designers are visual thinkers, we added icons as a visual summary for each ethical framework:



A pyramid for Plato [-427- -347]: Directive, aristocrat class society. Plato developed a theory of Ideas. He stated that there are two kinds of worlds, the word that we can perceive and the world of Ideas. In our perceived word, all things are ‘echo’s’ of the things in the Idea world. Only the Ideas in that world will bring true knowledge. Getting that knowledge will cost intellectual extortion. A philosopher can get knowledge out of the Ideas. Plato proposed higher class responsibility: the philosopher-king knows best what is good for everyone, because he has the best opportunity to have knowledge about the Idea of ‘good’ and ‘just’, so he should be in charge regarding what is best for the community. An ideal world for Plato, entails a top-down governed state in witch the ruler (the philosopher king) has all the power.

> *”Man is a tame or civilized animal; never the less, he requires proper instruction and a fortunate nature, and then of all animals he becomes the most divine and most civilized; but if he be insufficiently or ill-educated he is the most savage of earthly creatures.”*



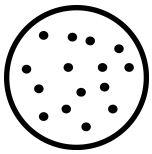
A circle for Jean-Jacques Rousseau (1712-1778): Social Contract: For Rousseau, in the past there was, what he called ‘a state of nature’. In this state of nature there a very few people who can live their life in peace, without shortages. But as the human population increased, people needed to live in villages, then cities and needed to collaborate in order to stay alive. It became important to be able to trust each other and ensure that everyone in society is protected. Therefore a ‘social contract’ became necessary. a contract created by the society and in which everyone in the society can assent to. An elected sovereign will

maintain the contract, but cannot change the rules in the contract.

"Find a form of association that will bring the whole common force to bear on defending and protecting each associate's person and goods, doing this in such a way that each of them, while uniting himself with all, still obeys only himself and remains as free as before."

A circle with a pie piece cut out for John Stuart Mill (1806-1873)
According to Utilitarianism , the consequences of one's actions should bring the greatest happiness or benefit for the largest amount of people. According to Mill, moral issues can be dealt with by calculating the maximum amount of happiness for the community as a whole, which means that there could be a situation in which certain minorities could be shunned from benefits if that leads to more happiness in general.

"The right act is the act which of all those open to the agent, will actually or probably produce the greatest amount of pleasure in the world-at-large. Pleasure and pain form the basis of the standard of right and wrong. The good of the community is simply the sum of the pleasures of the individuals who compose it."



A circle with dots for Immanuel Kant (1724-1804)
Principlism - Individual responsibility and acting according to individual morality. Kant stated that every person has a good will, and that its purpose is to regard to the moral law (categorical imperative). By doing that he should consider every intention that he has, whether that intention could be seen as an universal law, by which Kant meant that an intention is morally good when you could picture a world in which everyone would do follow up on that intention.
Kant stressed individual responsibility and being conscious of one's

own actions. In addition Kant mentioned that people should help each other to bring out other people's good will and help each other in what they want to accomplish. So a person should be considered as an end in itself.

> *"Nothing can possibly be conceived in the world, or even out of it, which can be called good, without qualification, except a good will."*

The students received factsheets with the essentials of the ethical framework of the philosopher that they had to work with, consisting of the icon, the philosopher's name, brief description of the ethical framework, keywords and some quotes. A philosophy graduate from Utrecht University gave lectures and interactive sessions to really make these framework come alive, also addressing the timeframe in which they operated.

Method

Fifteen students, involved in a minor co-design, worked on this project full time for four weeks. The students worked in four groups, each using the ethical framework of one philosopher. The first two weeks the students analyzed the problem, generated ideas and developed these into concepts. We asked the students to develop several provocative concepts, to explore the extremities of the solution space, much in line with the Philips approach of using –what they call- 'design probes' (Gardien, 2006), see figure 1 for an example.

Fig 1: Philips Design Probe: Filtering squatting toilet (source: http://www.design.philips.com).

Gardien states that, in order to design for future human needs, reflecting with users on the current situation does not provide useful insights. Instead, Philips design develops provocative concepts, and then 'throws these into the world' by means of realistic prototypes. Analyzing the reactions of people then gives insight in how people would live with these concepts. Following this line of thinking, the students developed one concept so they could discuss it with prospective users, and held several generative interviews. These interviews entailed creating a customer journey map (see Stickdorn & Schneider, 2010) of how they live with energy at the moment. Then, the 'design probe' was introduced, to initiate a discussion on how the participants would live in a future world where the smart grid service has become reality. See figure 2 for an example of a research kit, designed by a student design team to support the interviews.

Figure 2: Research kit for the Mill group: Left, top customer journey mapping materials, right: user scenarios for the 'collective household' concept.

The students analyzed the interviews and developed these into future user insights. In the final presentations, the students presented both the concepts that they developed, following the ethical framework provided, and the principal user insights from the interviews.

In several feedback meetings, students presented their ideas, concepts and research design. They were then coached on innovativeness and feasibility of their concepts on the one hand, and the way they fit the ethical framework provided on the other hand. In these meetings, the feedback panel consisted of an experienced designer, a smart grids expert from a project partner company, and a philosophy graduate.

Results

Below we present the designed smart grid services, some reactions from the user research, and a reflection on how the proposed service fits the ethical framework of the

philosopher given.

Plato: Neighbourhoodman

Instead of adjusting the energy supply to the demand, the supply of locally provided sustainable energy steers the demand: A locally appointed voluntary energy manager is in charge of balancing the demand with the available energy. People need to ask permission from the Neighbourhoodman to use large quantities of energy, for instance for the dishwasher or washing machine. If little energy is available, the Neighbourhoodman may decide which household needs it the most. The service experience was conveyed through a radio play, in addition to large sketches on brown paper (see figure 3).

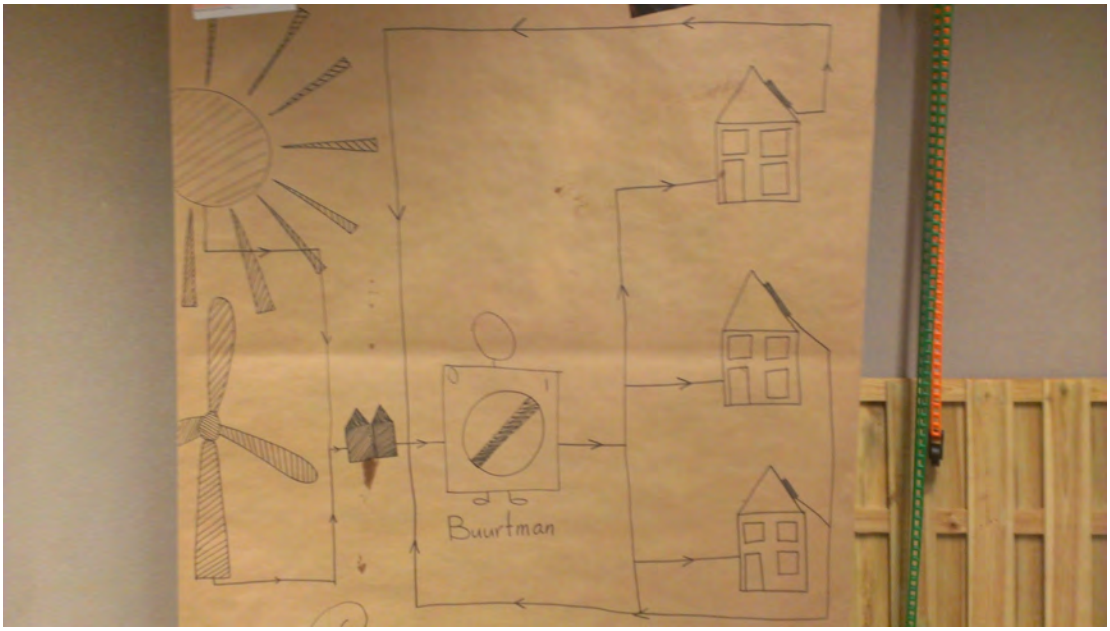


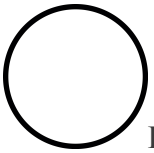
Fig 3: Sketch of the Neighbourhoodman concept.

When faced with this prospective future, people mentioned how they had positive experiences when faced with power shortages in the past: it inspires creativity and doing things that are different from the ordinary, playing games or reading instead of TV or internet. *"You know, then we would watch TV together with the neghbours, or play a*

board game, cosy!"

In addition, participants were OK with being deprived of energy at times, but they mentioned they would need to trust a fair distribution of the available energy. "*I think it is fair if everyone works towards not spoiling any energy".*

The Neighbourhoodman functions as the ruling 'king-philosopher' in the Platonian aristocracy.



Rousseau: Neighborhood as a 24-hour company

In the smart grid neighborhood of the future, you cannot just buy an apartment, you have to apply for the 'job'. Based on your energy usage profile over the day, you may get the job. The idea is that with a balance of different profiles, a neighborhood can make efficient use of available local energy: If there are a lot of 9-to-5'ers, new people will be recruited who use most energy during daytime, so either having nightshift jobs, or working from home. This way, the neighborhood collectively balances energy supply and demand.

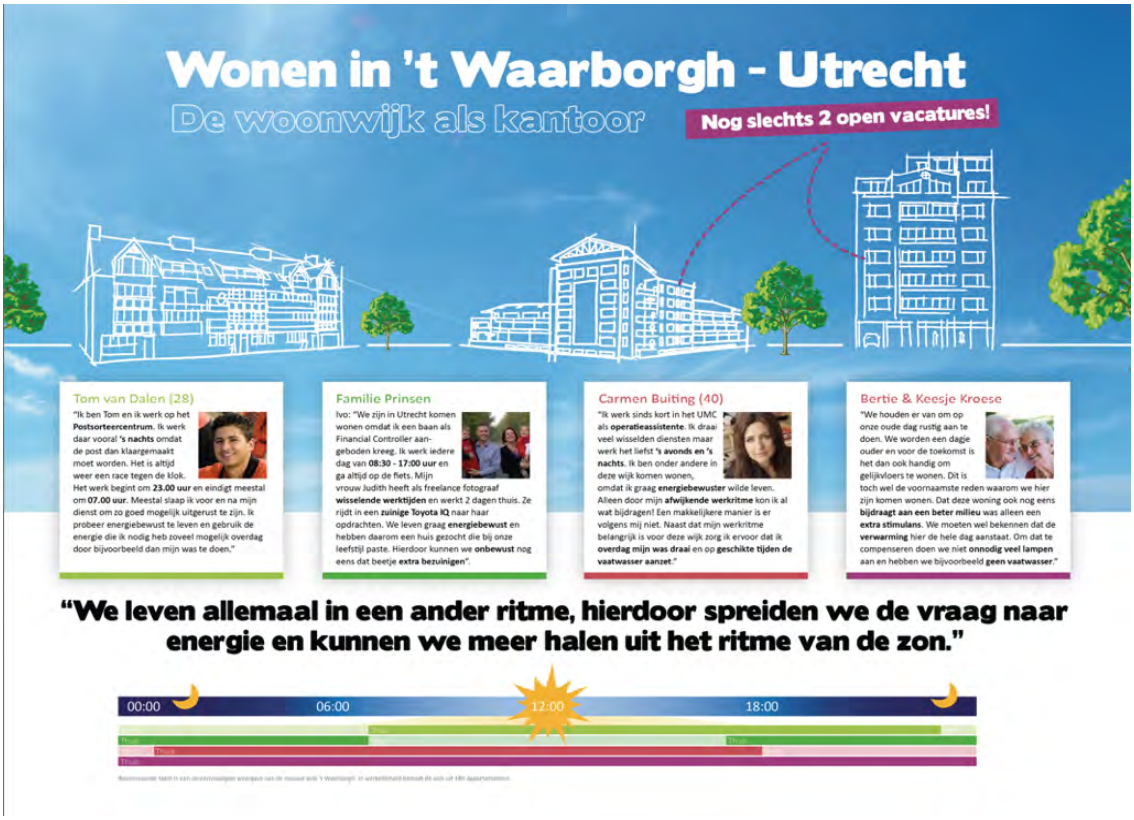


Fig 4: Advertisement for apartments for sale at the fictive neighborhood 't Waarborgh'. The poster shows different user profiles. The black text mentions "we all have different living rhythms. This way we spread our energy demand, so we can make better use of the rhythm of the sun.

When facing this future scenario people say that peoples' progressing lifecycle demands making conscious choices regarding where to live. *"If you look at your age, then you want to stay mobile. When you age, you still want to be able to go do the groceries and that you do not have to walk up too many stairs".* Participants also mentioned that priority given to consciousness of energy usage is determined by one's stage in life: *"On campus I could use as much energy I wanted, but now that I live independently I have to be more conscious in order to save".*

The neighbourhood as a committee fits Rousseau's perspective of making communal agreements, but the group failed to show how these agreements are enforced by committee. For instance, who is the application committee? What to do if people start using energy in a different way than the profile that they agreed on?

Mill: Communal household services

As most solar energy is available at times that most people are at work, this group decided to focus on developing shared household services, which can be done during daytime, like laundry, dishes, cooking, vacuuming, etc., which makes that people have more time to enjoy themselves, except for the group of workers that are needed to fulfill these services (see figure 5).

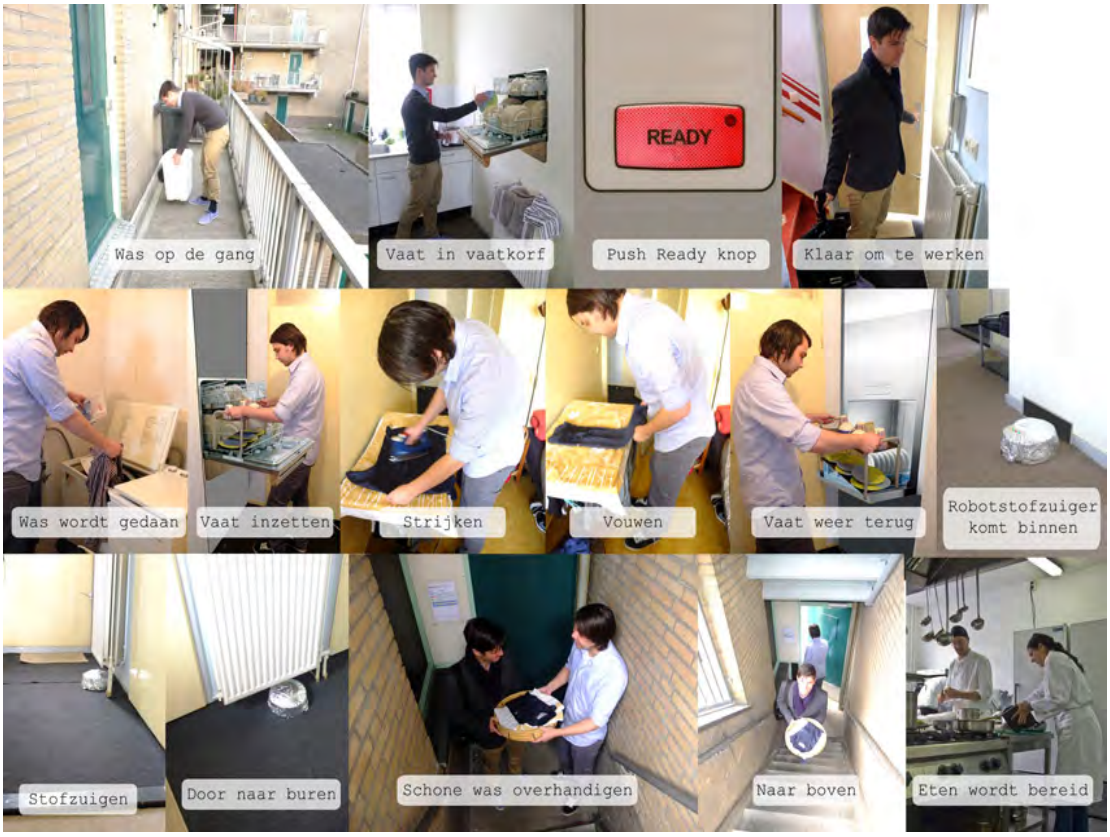
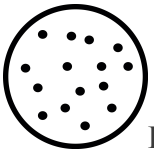


figure 5: A usage scenario of the communal house hold.

In the interviews, at first people thought this would be quite luxurious, not having to do any housework, but then, participants mentioned that they do want to be in control to decide which housework to outsource and which to do themselves. In response to the shared bathing facilities, participants mentioned that they would not be inclined to share a

regular shower, but more luxurious bathing services (sauna, whirlpool) are shared more easily.

The adagio of Mill is ‘the greatest happiness for the largest number of people, which is signified by the cleaning people having to labor, in order for other people to have more time to relax. Not having to worry about spending the right amount of energy all the time is a nice side effect.



Kant: Watch-it

The watch-it is an intelligent energy watch, which is intended to stimulate an individual’s consciousness about energy. The watch affords action taken from a distance. Of course, this also requires smart appliances that can be turned on remotely. The basic screen shows local energy availability prognosis over time (See figure 6). The left screen shows some statistics regarding energy availability and usage. The right-hand screen offers actionability. With a swiping movement, an appliance can be turned on from a different location. The ‘energy class’ of this action is presented as well: The Red bar with the ‘F’ shows that it is a not very eco-friendly move to turn on the washing machine at that time.

Fig. 6: Watch-It.

The interviews revealed that quite a few people have good intentions: they are prepared to deal with energy more consciously, but lack the knowledge how to go about. And, people are proud to tell about their energy-saving accomplishments.

In order to fit the Kantian ethical framework, the design team made a conscious choice not to provide an automated service, rather choosing to enable to allow people to act consciously and thus become more aware of energy usage in their home.

Discussion

The main objective of this project was to explore whether we could engage design students in thinking about moral issues by exploring different ethical frameworks in their designing. We will address this issue, but we will also reflect on how this student project affected the larger smart grids project. Finally, we will reflect on the use of design probes as a means to accumulate future user insights.

For design education and moral issues:

We found that our bachelor-level students were eager to learn about ethics. Product- and interface design tends to be a very hands-on practical education, and students were happy to also engage in some theoretical pondering. In fact, being given an ethical framework seemed to give the students structure when facing this complex and ill-defined challenge of developing smart-grid services. One student mentioned: *"At first I was very confused about the assignment, didn't know where to start, but when we were handed the philosopher, the challenge became much more straightforward"*.

We found that there were many more discussions regarding ethics during and after the assignment than could be expected from theory, like Lloyd et al (2005). However, the challenge did not allow students to take position regarding which ethical framework they would like to adhere to. We did have discussions on the topic, in which students considered their own morality, but the learning experience would have been complete if upon the design explorations and user research, the design teams were offered the opportunity to take position and develop their own ethical framework and experience the consequences in their designing. One of the authors did exactly this in his graduation project. He reflected on the insights from the co-design project and then developed an argument to take a Kantian perspective. According to Steenhuisen (2013), ownership of one's actions fits the current individualist mindset. He ended up designing a combination of an interactive screen in which one can set-up automated appliance actions, in combination with a key fob (figure 7), an 'energy heart' that makes users conscious about the extent to which their energy usage fits the current energy availability in different gradations: Misbalance of available energy makes the heart light up. Underuse gives a blue light, overuse a red light. If the misbalance continues, the key fob starts to vibrate. If overuse is way too high, the key fob may even heat up. To acknowledge the nudge, the owner needs to squeeze the key fob, which turns off the notification. This is intended to make the user aware of his energy usage, even when away from home. When they get back home, they can check-in with their key fob, to get information about how they could have handled better and learn to live in a smart grid network and by witch the user is seen as an end in itself.

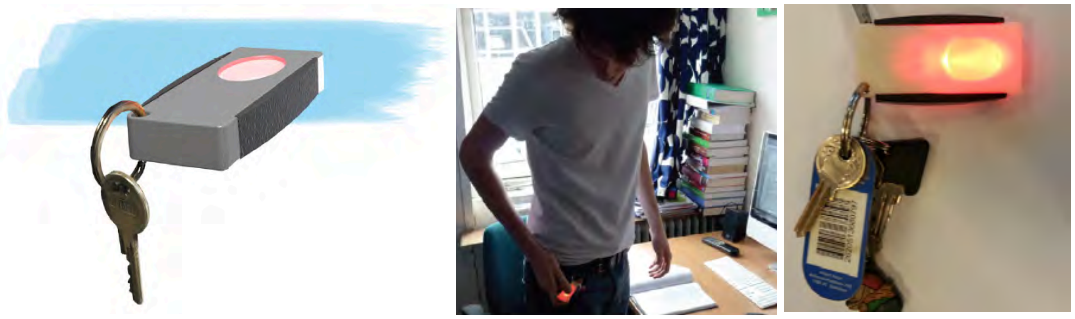


Figure 7: The energy heart key fob (Steenhuisen, 2013). :Left: product sketch, middle: usage situation, right: working prototype

In the months after the minor project we repeated the challenge in shorter and less intensely coached training programs. We found that these ethical design explorations always provided a rich field for ethical discussions. Both the depth and richness of the design concepts and of the ethical discussion was effected by the amount of time spent dealing it designing for a certain philosophical framework. Still, even a one-hour session already provided a rich and substantial discussion, lighting an ethical spark in designers.

For design research:

We found that the design probes did help users to step into a future perspective. But some priming activities were required: Making a customer journey map about current energy consciousness, before stepping towards the future invited deeper conversations. The students received a large amount of remarks which enabled them to develop insights that went beyond our initial assumptions. The service concepts were still a bit underdeveloped for allowing the interview participants to really dive into the future experience. In that sense, using wizard-of-oz prototypes (Buxton, 2007) in combination with acting out situations, could provide even better future user research results.

For the Smart Grids project team:

The student project provided new service concepts. Partners liked the fresh views on smart grid services, but easily discarded them as unfeasible, perhaps with exception of the Watch-it. They viewed the design probes as serious propositions for new services. And clearly, with all these concepts there are feasibility/desirability issues. A better

interface between the learning from the student project and the research project would have been desirable: Taking explicit time to ask the question what we could learn from these design explorations about the connection between problem- and solution space. Then in a professional workshop setting, new steps could be taken, based on these insights. Currently we are involved in a design research project for the airline industry in which we will further investigate this transfer of learning between student project and the professional world.

Acknowledgements

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