Energy objects: Reflection through interaction

Energy consumption and personal objects both play important roles in young people's everyday life and influence their behaviour in many different ways, although often unconsciously. This paper investigates how interaction design and speculative re-design of personal objects can be used as a means for raising young people's awareness of energy consumption. The concept of *energy objects* acts to make energy visible and tangible in order to stimulate reflection and reaction through the interaction with a collection of conceptual design proposals. Initial user feedback indicates that the presented collection of re-designed objects can be seen as an adequate tool in order to achieve reflection through interaction.

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INTRODUCTION

Our society has, according to the Swedish Energy Agency [10], become increasingly dependent on energy over the last century. A large number of electrically powered objects, appliances and gadgets are nowadays occupying our everyday lives and an overall awareness about the effects of energy consumption and its connection to our energy behaviour is in general low among the public [1]. Information campaigns, laws and regulations are traditional approaches to solve this kind of problems [11], but this paper investigates how interaction design, in combination with a speculative re-design of personal objects, can be used to reinforce people's awareness about energy consumption and stimulate a change of their energy behaviour in mundane life.

Young people, preferably between 15-25 years old, are seen as specifically interesting since they tend to adopt their energy behaviours at this age [1]. They are also about to create their own opinions, willing to explore and adapt new ideas, but also actively questioning the world as they see it today [12,13]. To have a prolonged effect on young people's attitudes, my belief is that the re-designed objects must be used on a daily basis and that the relationship to them should have some sort of personal connection in order to be truly effective and affective. My assumption is that the interaction with these objects can make abstract issues more tangible and act as an innovative and accessible way to generate discussions and reflections.

As an example of how to design for energy awareness, this paper introduces a collection of conceptual design proposals, which all illustrate how ordinary personal objects can be re-designed in a speculative way to evoke a reflection through interaction. The paper also discusses the role of speculative re-design as a provocative and critical tool for raising questions and starting reflections that could result in a change of existing behaviours.

RELATED DESIGN APPROACHES

Dunne and Raby approaches design from both an artistic and critical perspective in their experimental *Placebo Project* [3]. The project involves a series of one-off products, created to offer a sort of psychological comfort to its users in order to explore their relationships to invisible electromagnetic fields. Users participating in the experiment are seen as protagonists and asked to document the narratives that emerge over time as they live with their adopted objects. In *Alternatives* [4], Gaver and Martin proposes speculative design as a way to explore and shape new possibilities for everyday technologies. They introduce a workbook with conceptual design proposals of information appliances that are "occupying points in the design space without necessarily being the best devices to populate it" [4:216]. These conceptual design proposals are purposefully made ambiguous where many details are left unresolved in order to open conversations and obtain alternative perspectives of existing technology.

Social Mobiles [8] is a product-oriented branding project where IDEO, in collaboration with the artist and designer Crispin Jones, developed a number of prototypes that can be seen as an exploration of mobile phone behaviour and its social impact in everyday life. The provocative functionality of the prototypes

modifies, in different ways, the users' behaviour to make it less disruptive. Whirlpool Europe's *Project F* [6] uses an approach where design and foresight are combined in order to visualise and communicate an imaginable future for domestic appliances through highly realistic models of vivid concepts. A number of innovative future design concepts were developed by multi-disciplinary teams with experts offering opinions which were aggregated to form a view of possible futures in order to inform and influence policy-makers, but also to challenging people's preconceptions and affect future social acceptance of solutions that may require a change of expectation or change of behaviour.

As speculative or critical examples of conceptual design, they all work with both interactive and reactive behaviours of things to question and raise such issues with their audience or users. These examples also use interaction design, imagined or in practice, as a means of enquiry into everyday life situations and evolving product experiences.

INSPIRATION FROM YOUNG PEOPLE

In order to investigate young people's existing interaction with energy and their personal objects in mundane life, two methods were used: *cultural probes* and *personal inventory*.

Cultural probes

Cultural probes were initially deployed in the *Presence Project* and consisted of a provocative collection of tasks and materials designed to elicit inspiring responses from the participants about their individual lives [5]. The method is an alternative to more traditional methods of user research, such as interviews, questionnaires or ethnographic studies.

Figure 1: Cultural probe packages (left) were given to eight students and returned after a few days (right).

My probes were used to achieve a better understanding of young people's habits, thoughts and perceptions of energy in specific, but also to get a glimpse of their relationship to personal objects and the impact they might have in their mundane life. The probes contained a disposable camera, a pen, a set of dot stickers and a small booklet with instructions and reflective questions (see Figure 1). These probes were given to nine students—five upper secondary school students in industrial design and four master students in interaction design—in the age group of 15-25 years and collected after a few days. Among the findings from the returns was the fact that many of the students perceived electromagnetic radiation from mobile phones as a dangerous form of energy, and that many of them had music players as their favourite personal object. Electricity and electronic appliances were often related to energy, but some students also associated energy with human power, sun, animals, heat and food.

Personal inventory

To find out more about the personal objects young people surround themselves with on a daily basis, a personal inventory can be appropriate to document the things people identify as being important to them [9]. Asking people to show and describe their personal objects makes it possible to document and categorise evidence of their lifestyles, which can be useful for revealing their activities, perceptions, and values as well as patterns among them.

Figure 2: Personal inventory of a backpack (left) and a handbag (right), owned and used by two students.

Sixteen master students in interaction design at various ages were asked, without any prior notice, to empty their handbags and backpacks on a table and the content was documented with a digital camera (see Figure 2). Common objects were mobile phones, pens, wallets, calendars, coins and keys. Other more rare things were a Leatherman tool, a key padlock, a pack of cards, a ring, a clarinet mouthpiece, a patent application, a pocket mirror and a marsh tree seed.

CONCEPTUAL DESIGN PROPOSALS

My creative process, to a large extent inspired by the findings from probe returns and personal inventory, resulted in a small collection of conceptual design proposals where a number of ordinary personal objects were given a speculative re-design. The collection is categorised in three themes, each of them exploring specific aspects of *visualisation, generation,* and the *localisation* of energy. These aspects were selected in favour to others, e.g. measuring, storing, and sharing of energy, mostly because they could be associated to findings in the inspirational material collected from young people, but they also addresses issues related to energy that concerns young people of today in their everyday life.

The three themes of conceptual design proposals are briefly described below in order to provide concrete examples of how re-designed personal objects can appear as a means to stimulate reflection and raise energy awareness among young people. They are all visualised and communicated through sketches where the objects are purposely diagrammatic and vaguely familiar to focus the discussions on interaction rather than on form. As speculative design examples, the concept of *energy objects* act to stimulate reflection and reaction in their intended interaction where re-design is used as a method for rethinking basic notions of objects and use.

Energy visualisation

The probe returns showed that many students thought that mobile phones represented a "dangerous" form of energy. This was an interesting contradiction; especially since almost all students participating in the personal inventory carried a mobile phone in their bag and used it frequently on a daily basis. In order to evoke some reactions among young people, it became obvious that the invisible and intangible nature of electromagnetic radiation had to achieve some sort of physical representation. Without committing to whether mobile phone radiation is unhealthy and dangerous or not, these proposals all act as ambiguous displays visualising this kind of radiation.

The *accessories* (see Figure 3) were inspired from dosimeters; badges indicating exposure of radioactive radiation. In similar ways, these accessories react to and visualises the amount of "dangerous" radiation from mobile phones that is exposed to its user. The *key strap* is sensitive to such radiation and reacts with an augmented effect by slowly dissolving the material, which in the end will make it non-functional. The fact that these straps are commonly used by young people to hold, not only important things like keys, but also their mobile phones, further emphasises the contradiction where increasing daily usage of mobile phones substantially decreases the important functionality of the key straps.

Figure 3: Accessories that react to and visualises the amount of mobile phone radiation exposed to the users.

The *medallion* slowly releases small red drops in its glass container when exposed to mobile phone radiation, resulting in a visual effect similar to a lava lamp. Both the key strap and the medallion display accumulated, in an ambiguous way, values of electromagnetic radiation exposure. The red drops may be perceived as blood originating from the users body, but its aesthetical appearance and poetical nature leaves the interpretation open for speculation. The high visibility of the medallion, as for most jewellery, forces the wearer into a number of dilemmas; showing the medallion to others implies explicit knowledge about the owner's exposure to radiation, while hiding it away contradicts the very notion of jewellery—to be seen. Another dilemma occurs if the owner decides not to wear the medallion. Then its main purpose will fail, leaving the owner unaware of the possible risks during extensive mobile phone usage.

Unlike the above mentioned proposals, the *bracelet* instantly indicates the current amount of radiation exposure by printing a graph on a paper. This extensive amount of received information forces the wearer to continuously make decisions whether to give attention to or ignore the results being displayed. Individual interpretations of how to use the printouts are encouraged by not offering any fixed solutions. Instead, personal preferences and interest in this kind of information will determine the usage. Some users may collect the printouts for further analysis, knowing important information could have been missed, while others may throw them away instantly without any further attention. The printouts may be given away as gifts or used as a tool during an exploration of the invisible electromagnetic radiation in the surrounding environment.

Energy generation

The personal inventory showed that many of the objects used by the students, e.g. mobile phones and music players, require electricity to work—an energy source not always available or affordable. A problem with electrically powered objects is that they quickly run out of power and therefore often needs to be recharged. Changing focus from consumption to generation could perhaps make young people more aware of the costs of producing energy, whether it is in a small or a large scale.
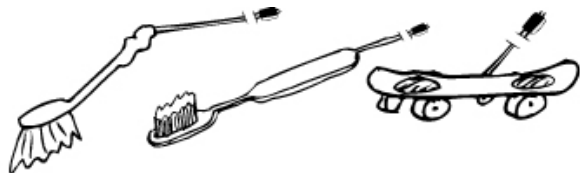

Figure 4: Battery chargers suggesting sustainable choices for generating energy with physical effort.

The *battery chargers* (see Figure 4) give young people a choice to generate energy by their own in a sustainable way, to be used instantly or perhaps saved for later use. Instead of plugging an ordinary battery charger into a wall socket, users can charge their mobile phones while brushing their teeth or powering other electrical gadgets by using a natural form of interaction with ordinary objects and tasks that is either fun or necessary, e.g. skateboarding or doing the dishes.

This re-interpretation of ordinary and daily activities can act as an incitement to adopt a change in energy consumption among a group of people where energy is often taken for granted. In the end, this may generate some interesting interpretations of the battery chargers and it is possible that alternative energy behaviours will evolve over time. The physical effort resulting from ordinary activities can give young people a deeper awareness about energy and a hint of the relation between producing versus consuming. It may for example be sufficient to power music players while skating from school but a month of brushing to fully charge the electrical tooth brush.

Energy localisation

In the probe returns, some students associated energy with natural and sustainable energy sources like wind-, wave-, and solar power. Even though these forms of energy are constantly present and always surrounding us, we tend to not think of their presence. Another finding from the probes was that students mentioned music players as their favourite personal object. One reason for this appreciation was the company they brought during travelling or waiting. It would be interesting to combine these two findings as a way to explore the localisation of energy.

All *music players* (see Figure 5) must be provided with energy from different sources to work properly, since they have no batteries of their own. In order to play music, young people are forced to continuously explore, localise and parasite on available energy sources in the surrounding environment. One of the music players is powered from wind that could be gained by running fast, holding the player in the hand; another of them requires a temperature difference and may parasite on the heat from an indoor radiator. Each music player is equipped with an ambiguous indicator, making it difficult to intuitively, without testing, knowing how much energy is actually needed.
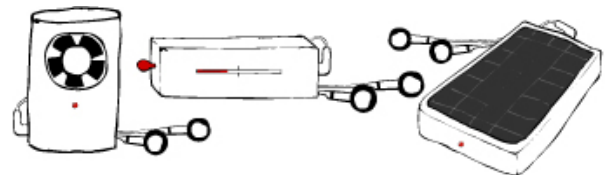

Figure 5: Music players powered with natural energy sources like wind, heat, and the sun.

When power gets short, the user has to continue the search for another energy source that could provide the player with new power, which could lead to new findings about undiscovered locations of hidden energy sources. This uncertainty about available power sources produces a strong feeling of dependency and the exploration can be seen as an intricate way to gain awareness about the energy geography in the surroundings. The players also illustrate that we sometimes have to surrender some control to larger structures outside our own control, e.g. the solar driven music player that stops working if it is cloudy.

FEEDBACK FROM YOUNG PEOPLE

Initial user feedback about the conceptual design proposals and the ideas behind them were received during a workshop with five master students in interaction design. The sketches of the proposals were grouped in three themes as described above and introduced with a short background description. The proposals were, according to the students, seen as enough simple and clear to both illustrate and communicate the ideas behind them, but more descriptive information about their context were desirable in order to fully understand the concepts. Improved understanding of the interaction could possibly be achieved if the proposals were represented with physical mock-ups or prototypes that users could actually feel, test, and use in some way. Physical representations could, on the other hand, also

render some negative effects if discussions changed focus from reflections towards opinions about shape and form.

The themes of *energy generation* and *energy localisation* were in general considered easier to understand than the theme of *energy visualisation*. Some of the accessories in the latter theme were instead proposed to visualise the amount of energy generated by objects from the other two themes. Many students also feared that emphasising aspects of dangerous energy would support paranoia against mobile phone usage. In contradiction, one student saw the accessories as the only objects actually starting a process of reflection about energy.

Using personal objects for mediating the ideas were overall seen as positive. Most of the students said that the objects trigged some sort of reflection about energy, even though many of them had difficulties in articulating exactly what effect it would have in their everyday life. They also thought it was difficult to say in what context the conceptual design proposals should be used to gain most effect. Implementing them as working products, used on a daily basis in everyday life, was not seen as a real option, mostly because of frustration where these objects probably have to stand back for existing products. A better effect could possibly be achieved if the objects were subject for an exhibition, even though the long term impact on visitor's energy behaviour seemed hard to predict.

DISCUSSION

The three themes presented above explore one and each a specific issue of energy awareness. But they also highlight and comment on more comprehensive aspects regarding young people's everyday relationship to energy and some specific characteristics related to speculative re-design as a provocative and critical tool.

Different comprehensive aspects of energy awareness

One aspect is the *dependency on energy* where the constant need for electricity makes us both dependent and vulnerable to circumstances we are not always able to influence ourselves. The music players and the battery chargers both act as reminders of that electrical energy cannot be taken for granted. As for the music players, users are totally exposed to environmental circumstances, and in order to use them it becomes necessary to constantly search and find alternative sources of energy. The battery chargers offer an always available alternative to generate energy instead of using wall sockets. Another interesting aspect is the *choices* young people have to make on an everyday basis regarding their own consumption of energy. The accessories force young people to actively decide to what degree they are willing to be exposed to "dangerous" energy connected to their usage of mobile phones. The battery chargers suggests a sustainable choice for charging batteries that also demand physical effort in comparison to electricity—easily gained from any wall socket, although more expensive.

A third aspect is the *psychological and social consequences* resulting from interaction with the objects. Wearing any of the accessories puts the wearer in a psychological uncomfortable situation monitoring the radiation exposure and in a social dilemma whether the accessories should be visible to others or not, knowing that jewellery are seen as personal expressions articulating, to themselves and to others, who they are and what they stand for. The intended usage of the music players and the battery chargers may result in a strange behaviour, not seen as socially acceptable or desirable among young people. The last aspect emphasise the fact that *it costs to use energy*. Whether they buy electricity or generate energy with physical effort, young people have to invest something in order to use energy. It can even be the health if exposed to large amounts of electromagnetic radiation from extensive mobile phone usage.

The conceptual design proposals as provocative mediators

It is not yet possible to decide whether these conceptual design proposals of re-designed personal objects can be perceived as successful provocative mediators for raising energy awareness among young people. Many students disliked the accessories, mostly because they feared a possible paranoia against mobile phone usage. This reaction can be seen as positive since the provocative approach of them aims to raise such uncomfortable questions about the perceived, but hidden, phenomenon of "dangerous" energy. The fictive nature of the battery chargers was considered to be an important factor enabling them to work in a speculative way. Many students directly imagined situations where such chargers could be used and started to calculate how much effort was needed in order to charge mobile phones and other electrical gadgets. The music players seemed to be, in opposite to the chargers, less fictive and were also much more questioned regarding their technology and functionality. The speculative re-design representing them was perhaps too realistic to imply any deeper reflection about the topic of energy localisation, which could indicate that familiar and existing technology may be an obstacle for imagination.

It can be discussed, even though many of the speculative ideas behind the conceptual design proposals seemed to work as intended, whether the format of presentation was appropriate for all of them. Initial user feedback indicates that the way concepts are presented and communicated to its audience becomes crucial in order to achieve a wished result [cf. 2,7]. It is possible that other kinds of representations, e.g. mock-ups, working prototypes, or video scenarios, could render other results and findings. An actual interaction with physical objects would probably be more appropriate and result in a more in-depth reflection regarding the provocative nature of these objects than, for example, imagined interaction via sketches.

Speculative re-design versus critical design

The fact that all of the design proposals were modifications of already existing objects made it difficult for some students to engage with the new re-design and to critically rethink basic assumptions about their existing functionality. This ambiguity inherent in the objects, where they fulfil a purpose besides its original function, is a common characterisation for both critical design and speculative design [cf. 3,4]. Likewise is the view on design as a tool for provoking and challenging people's pre-conceptions about relevant issues and for raising important questions, rather than giving answers.

One thing that differentiates speculative re-design from critical design is the intended context of use. Dunne and Raby [3:59] proclaim that "critical design can never be truly popular, and that is its fundamental problem. Objects that are critical of industry's agenda are unlikely to be funded by industry. As a result, they will tend to remain one-offs". While critical design often resides outside the market place, e.g. in exhibitions and museums, speculative re-design are more likely to be found in the creation of imaginable future prototypes [cf. 6] that are, despite its provocative and speculative nature, both feasible and possible to mass-produce with an aim to be used in everyday life.

This differential characteristic of speculative re-design can be of decisive importance to achieve greatest possible impact among young people with regards to their long term changes of energy behaviour. Introducing feasible re-interpretations of existing and familiar personal objects, instead of designing totally new objects, could perhaps make it easier for young people to both recognise and reflect upon their own relation towards these objects and imagine the intended interaction with the conceptual design proposals.

Reflection through interaction

The conceptual design proposals presented in this paper are all examples of interaction design with an approach of speculative re-design and they can be seen as imaginative alternatives that occupy points in the design space. Their fictiveness provoked some initial thoughts among students, but some of them seemed to have difficulties imagine possible effects from a daily interaction by just looking at sketches. In order to reach a more profound awareness and a long term change in their energy behaviour, young people probably need to live with the objects on a daily basis where they interact and reflect about the provocative effects inherited in the objects for a longer period of time. These examples of speculative re-design could, if implemented as personal props in everyday life, perhaps render some sort of psychological and social discomfort during interaction that implies modifications in the way young people live with their energy objects—in the end affecting their energy behaviour. Introducing energy as a basic design material gives the objects both interactive and provocative properties—important in order to receive reactions and achieve reflection through interaction.

CONCLUDING REMARKS

This paper proposes interaction design, in combination with speculative re-design for personal objects, as a means to raise energy awareness among young people. Results from initial user feedback indicates that the speculative and provocative ideas behind the proposed collection of *energy objects* do have influence on young people's energy awareness, even though physical representations of the concept and more time for individual interpretation perhaps can give an even more profound reflection through interaction.

It is suggested that the re-designed objects should be used by young people on a daily basis in order to be truly effective and affective. The presented conceptual design proposals should therefore be seen as potential products rather than as critical imaginable one-offs, where further development should begin with refined representations of the design proposals, e.g. in form of physical mock-ups or working prototypes. These should be used for in-depth user studies where young people use the re-designed objects over a longer period of time so that the effects of interacting with them on a daily basis could be both identified and analysed.

The results from this evaluation could form the base for future directions and indicate whether the *energy objects* suits best to be distributed through the traditional product market-system, perhaps resulting in a widespread usage that directly affects young people's energy behaviour, or through research-context tests, where the results and examples indirectly could be used to spark social debates and trigger personal reflections that in the end could raise the energy awareness among young people.

REFERENCES

1. Carlsson-Kanyama, A., Lindén, A-L, and Eriksson, B. (2003). *Hushållskunder på energimarknaden. Beteenden och värderingar*. Report 181, Stockholm: FMS/FOI.

2. Dunne, A. (1999). *Hertzian Tales: Electronic products, aesthetic experience and critical design*. London: RCA CRD Research publications.

3. Dunne, A. and Raby, F. (2001). *Design Noir: The Secret Life of Electronic Objects*. August/Birkhäuser, Basel.

4. Gaver, B. and Martin, H. (2000). Alternatives; Exploring Information Appliances through Conceptual Design Proposals. In *Proceedings of CHI 2000*, pp. 209-216, The Hague, Amsterdam, ACM Press.

5. Gaver, W. and Dunne, A. (1999). Projected Realities; Conceptual Design for Cultural Effect. In *Proceedings of CHI 1999*, pp. 600-607, Pittsburgh, PA, ACM Press.

6. Gabrielli, S. and Zoels, J-C. (2003). Creating imaginable futures: using human-centered design strategies as a foresight tool. In *Proceedings of the 2003 conference on Designing for user experiences*, pp. 1-14, San Francisco, CA, ACM Press.

7. Houde, S. and Hill, C. (1997). *What do prototypes prototype?* In Handbook of Human-Computer Interaction, 2nd edition, Helander M., Landauer T., Prabhu P. (Eds.), Elsevier Science B. V., Amsterdam.

8. IDEO and Jones, C. (2003). *Social Mobiles*. Available at: http://www.ideo.com/case_studies/social_mobiles/index.html

9. Interval Research Corporation. (1998). *Portable Effects: A survey of nomadic design practice*. Technical Report #TR1998-003. Report available at: http://www.portablefx.com

10. Energimyndigheten/Swedish Energy Agency. (2004). *The Energy Market 2004*. ID-No: ET29:2004. Report available at: http://www.stem.se

11. Energimyndigheten/Swedish Energy Agency. (2005). *Energy in Sweden 2004*. ID-No: ET19:2004. Report available at: http://www.stem.se

12. Ungdomssstyrelsen/The Swedish National Board for Youth Affairs. (2003). *De kallar oss unga: Ungdomsstyrelsens Attityd- och värderingsstudie 2003*. ISBN 91-89050-48-7. Report available at: http://www.ungdomsstyrelsen.se

13. Ungdomssstyrelsen/The Swedish National Board for Youth Affairs. (2001). *Bara vara*. ISBN 91-89050-40-1. Report available at: http://www.ungdomsstyrelsen.se