THAT'S THE SMELL OF PEACETIME - DESIGNING FOR ELECTRICITY LOAD BALANCING

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ABSTRACT

In this exploratory paper we review, reflect, and react upon recent research that heavily critiques common design approaches towards electricity load balancing. Through this review we identify overlooked opportunity spaces for design in which we situate a prototype called Peacetime as an alternative approach to load balancing on the electrical grid. In sharp contrast to home energy management systems (HEMS) and in-home displays (IHD's) which provide detailed energy data, Peacetime employs frameworks from slow time and emotional design, and from ambient multimodal interfaces to create a stronger and different experience in relation to load balancing. We present the Peacetime concept in detail and discuss its implication for future designs within the field of Sustainable Interaction Design.

INTRODUCTION

Peak hours are periods during the day when there is a lot of activity on the electrical grid. In residential buildings those generally occur in the morning and in the evening hours when people use electricity at the same time to get ready for school and work and when they come home. To keep up with the demand of electricity, energy companies fire up additional oil burners or use more fuel sources resulting in huge CO2 emissions. Moving energy-consuming activities to non-peak hours is called peak shaving or load management and is generally considered one trend in the smart grid scenario that could help lower CO2 emissions (Christiansen, Gram-Hanssen & Friiset 2012).

One essential discussion in load management is whether the customers should actively shift their energy pattern and activities, called 'direct control', or if the energy companies should manage energy systems automatically, referred to as 'indirect control' (Van Dam et al. 2010). Researchers and energy companies have studied and explored load balancing through various modes and techniques such as dynamic pricing and automation (eg. Fischer 2008, Gleerup et al. 2010, Bartusch et al, 2011). Yolande Strengers explores this dichotomy by illustrating, through a persona she calls Resource Man, how these approaches can be too narrow and restrictive (Strengers 2014).

RESOURCE MAN

"Resource Man represents the energy industry's 'resource bias' projected onto energy consumers… [Resource Man] is interested in his own energy data, understands it, and wants to use it to change the way he uses energy. He responds rationally to price signals and makes informed decisions based on up-to-date and detailed data provided about the costs, resource units (like kilowatt hours), and impacts (like greenhouse gas emissions) of his consumption. For these tasks he needs information, dynamic prices and enabling technologies" (Strengers 2014, p.26).

For the direct control approach these personality traits are beneficial. Home energy management systems (HEMS) or in-home displays (IHD's) may be enough for Resource Man. Strengers presents a framework to think beyond the Resource Man approach by suggesting to 'design for others' and 'design for slow time'.

DESIGNING FOR OTHERS

Strengers points out "there is significant scope to consider other people, animals, and things in the home, their relationship with each other, and the implications for energy consumption" (Strengers 2014, p.29). This is an inspiring perspective that with further consideration opens up interesting opportunities.

It seems that there is a current desire and felt need to quiet the noise that comes from being hyper-connected. Yoga and meditation are becoming more popular. There are viral videos like Look Up (2014) that illustrate how humans are losing the ability to connect with people in a real and genuine way due to hiding behind the noise of technology. Taking these things into consideration and shifting focus towards strengthening human-to-human interaction in the home, we ask what the effect might be on energy consumption.

DESIGNING FOR SLOW TIME.

Strengers informs that social researchers are investigating the flexibility that people have with their energy practices as a way to possibly move activities or find "alternative household activities and adaptations that use low or minimal electricity" during peak hours. She states, "Studies of blackouts and other electricity interruptions have revealed … [that] when the power goes out people are often to slow down, and this can be both deeply frustrating and thoroughly enjoyable." One example of this was during a blackout in a small Swedish society where 9 months later roughly 2% of the population was pregnant (Aftonbladet 2001).

Downtime, or slow time (Hallnäs, Redström 2001) opens many opportunities for design, but the reason could, with thoughtful consideration, be intentional. If the slow time could become an intentional disconnection from energy consuming technology as "Slow energy" (Pierce, Paulos 2012) in order to quiet the noise, maybe people could reconnect in a more genuine way with others; where sitting and talking by candle light is romantic -as opposed to sitting in front of a television watching a movie. An example of a slow time design concept recently went viral. The Dolmio Pepper Hacker turns off Wi-Fi, mobile devices, and televisions for 30 minutes so families can have quality time together during dinner without being interrupted by technology. (Dolmio Australia 2015)

EMOTIONAL DESIGN

To understand why people engage and aspire for eco-friendly behaviour is a multifaceted topic. Two commonly used models are (1) The rational choice model and (2) the norm activation model. The rational choice model is based upon reasoning about cost and benefits whereas the norm activation model is concerned with moral and emotional beliefs and responsibility towards future generations and wildlife (Froelich, Findlater & Landay, 2010). The framework of emotional design proposes that the following three categories should be considered to create a strong emotional experience, (1) The Experience of aesthetics, (2) The experience of meaning and (3) The Experience of emotions (Desmeth 2007).

One example of an emotional eco-feed back is the Amphiro water and energy meter (2015). A gadget mounted on the shower handle, which displays the temperature of the water and the amount of water consumed. This information is displayed in numbers along with an illustration of a polar bear on ice. The more warm water used the more the ice melts and the polar bear sinks, clearly linking to the norm activation model, of responsibility towards wildlife.

MULTIMODALITY IN AMBIENT INTERFACES

Ambient interfaces are interfaces that are embedded and integrated into everyday life. They surround us and as slow or calm technology they communicate to users in a peaceful manner (Weiser, Brown 1996). Apart from vision, ambient interfaces could potentially communicate to users through sensory modalities such as smell, sound, taste, and touch. As humans communicate and relate to the their surroundings through all senses, multimodality is looked upon as an opportunity to effectively communicate and create ambient interfaces. Researchers argue that ambient interfaces have not yet started to consider other modalities and vision is still the modality generally applied (Obrist et al. 2014).

In the field of Sustainable Interaction Design (Blevis 2007), there are examples of ambient interfaces for eco feedback; Katzeff et al. (2013) gives a brief overview. However most of them depend mainly on vision (e.g. Broms et al. 2010, Gyllenswärd, Gustafsson 2005). One example involving sound is The erratic radio that communicates through a buzzing sound when users are consuming large amounts of energy in the household (Mazé et al. 2010). However humans have 4 other senses: Smell, sound, taste and touch. Smell is a modality that has rarely been integrated into interfaces; see Pedersen and Sokoler (1997) for an early paper on this. Another research paper recently reported on a study collecting smell stories and explored design opportunities on how this modality could be integrated in HCI (Obrist et al. 2014). The researchers highlighted opportunities for smell as an emotional means to motivate behaviour change in HCI (Obrist et al. 2014).

OUTLINE OF THE PAPER

Although Peacetime is part of a 3-year research project,

the focus of this paper is to explore, reflect upon, and pose new discussions around the different lenses and layers in which the Peacetime prototype can be framed and situated as a possible contribution to the discourse. The deployment and study of the prototype is not included in this paper, rather the focus is on the qualities of the design artifact as a reflection on alternative design frameworks and how they can be applied to Sustainable Interaction Design. Following we briefly explain the process resulting in the design and present the details of the concept. Lastly, we discuss how this design occupies alternative approaches to load balancing.

METHODOLOGY

Research through Design (RtD) is a commonly considered an approach to create, embody and investigate the future as it could be (Frayling 1993, Gaver 2012 , Zimmerman et al. 2007, 2014). This paper focuses on the embodied knowledge gained by investigating the potential for load balancing through a series of User Centered Design activities that resulted in the Peacetime concept. Initially, a qualitative field study with 10 interviews informed the design which was co-created with users through workshops and discussed in focus groups. See Wessman et al. (2015) for a thorough rendering of the process resulting in the Peactime concept.

THE PEACETIME PROTOTYPE

Peacetime is an ambient multimodal interface that communicates the specific times of peak hours to users. However the concept adopts a positive approach. The term 'peak hours' are avoided and rather than instructing what not to do, and when not use electricity; the peak hours are considered an opportunity for peaceful activities while disconnecting from the electrical grid. It is, in essence, a designated time for peacefulness, which strongly correlates with nature linking to the norm activation model. It invites people to participate in inspiring alternative activities, which do not require electricity. The concept consists of two parts; a physical object and a website. Adopting a multimodal strategy, they together communicate the designated disconnection time, called peacetime, to users.

ARTEFACT

The physical object consists of a tree with a nest, a pinecone and three physical birds associated to the nest (fig. 1,2). The birds produce a sound signal at different times. 30 minutes before the peacetime starts, the birds will make two chirps to draw attention to the approach peacetime and 15 minutes before the birds will make three chirps. When peacetime begins, the birds will sing a melody. The duration of the song correlates to

Figure 1: A staged photograph of the physical Peacetime prototype.

Figure 2: The chirping birds made out of wood

Figure 3: The nest and the pinecone indicate how much Peacetime is left.

Figure 4: At the base of the prototype is the scent flower, where the scent emanuates during Peacetime.

the length of the peacetime session. People can choose to place the birds at the nest or at different locations in their house where they prefer this sound feedback. When the peacetime begins, the pinecone drops and slowly moves up towards the nest again acting much like an hourglass to visually indicate the remaining time.

SCENT

When a peacetime begins a fragrance, inspired by nature, will emanate from the flower and do so continuously throughout the whole peacetime session (Figure 3). Different scents are available to accommodate individual preferences.

Peacetime.se

The website displays the designated peacetimes 3 days at a time in a classical calendar view (fig. 4). There is a gallery associated with the scheduled peacetime sessions, which offers customized suggestions for non-electricity consuming activities. The activities are presented with short texts and pictures. The activity suggestions are inspired and based on the families' profile and include a range of categories: from crafting and socializing, games and singing, to adventures and small tasks.

Figure 5: The Peacetime website informs of upcoming Peacetime periods and gives custom-made alternative activities from which to choose.

DISCUSSION AND REFLECTION

In the following four sections we dicuss how the Peacetime prototype could occupy alternative approaches and bring new opportunity spaces and implications to consider when designing for load balancing.

AN INVITATION

As our field study revealed, the participants expressed their repulsion towards penalties. Obviously this approach could present a problem due to it's negative undertones. People often do not like to be told what they should or should not do and furthermore not be punished for it. Dynamic pricing strategies which indicate times of higher and lower electricity costs can also be indirectly negative by causing feelings of guilt if a person chooses not to follow the suggestion. It could be fruitful to think about how a load balancing approach can invite people to participate in a positive way. Under this lens, Peacetime offers a few possible examples.

The attention to the design of the physical prototype itself could be considered an invitation. In contrast to the HEMS and IHD's which focus on presenting data and graphs on screens, Peacetime employs an ambient emotional interface. It is not subtle and small but yet its purpose is not to scream for attention. In that way, Peacetime becomes an obvious object in the room that serves as a gentle reminder and an opportunity to disconnect.

Since the prototype is multimodal, the sounds and fragrance emitted could be considered pleasant and engage people to participate. Similarly, how the sound of an ice cream truck builds up excitement the sounds of the chirping birds could invite people to participate in alternative engaging activities.

Information stress is however subjective and even though we have carefully chosen the sound of chirping birds this might be perceived as annoying to some users. Fragrance has a lot of potential and researchers have called for this opportunity (Obrist et al. 2014). The fact that this modality is not commonly applied is also an opportunity to consider.

EMOTIONAL CONNECTIONS TO NATURE AND PEACEFULNESS

Strengers states that "detailed feedback on a household's resource consumption (kilowatt hours) costs of energy (detailed billing information), and resource impacts (greenhouse gas emissions)" are the primary types of information given to consumers to empower them to make decisions about their energy behaviors. Although providing information on CO2 and greenhouse gas emissions is one approach to applying the norm activation model of appealing to one's responsibility towards future generations and wildlife, other approaches could be explored to create a stronger emotional connection to nature. By applying the framework of emotional design, Peacetime can be viewed as an example that strives to present the connection to nature in a stronger more emotional way.

Corresponding to the framework of emotional design where (1) The Experience of aesthetics, (2) The experience of meaning and (3) The Experience of emotions, contributes to a stronger experience (Desmet 2007), the aesthetics of the Peacetime concept is deliberately chosen for a calm nature-oriented semiotics. The shape is inspired by nature and the materials are chosen with crafted material properties. Untreated wood and crochet are present in all parts: the body of the tree is cut from birch plywood, the nest and flower are crocheted, the birds are modeled from solid birch wood, and the website resembles the crocheted texture. The pinecone has a darker colour to stand out in order to indicate its position as the main visual modality of the ambient interface. For some, caring for the nature might be an obvious connection and incentive as to why they might shift activities and decrease their CO2 footprint. For others, the semantics of the prototype could hopefully inspire and give peaceful connotations. The sensory stimuli might also tap into other emotions that would have been disregarded with a graph on a screen.

ACCESSIBILITY AND INCLUSIVITY

Home energy management systems (HEMS), and in-home displays (IHD's) which provide consumption feedback create limitations by only being applicable to those who can read, see, and interpret data. It is not our intent to introduce the Peacetime concept as a solution for all non-resource men, but it is an attempt to address other types of users. A child for example might not be able to interpret some of the information on HEMS and IHD's but to hear a chirping bird or to smell a cherry blossom is a completely different approach. The pinecone moving up might also be a much clearer indication for others. An 85 year old grandmother might not hear the chirping birds but she might see the pine cone and smell the scent she chose. People with disabilities such as low vision could also access information through the chirping birds and the scent.

HUMAN TO HUMAN INTERACTIONS

An interesting question arose by reflecting on the suggestions for alternate activities during the peacetime. Could a focus on encouraging people to connect with each other, while disconnecting from technology, have a positive impact on load balancing? In other words, if we shift the goal to encourage human to human interaction

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for a few hours a week during energy peaks, could there be a positive effect both on the energy consumption during peaks, as well as one's receptiveness and willingness to actually disconnect from electricity.

A potential scenario could be that a family would look forward to the upcoming Peacetime as an opportunity to do something together. The Peacetime could potentially result in more human to human interactions where families or couples would spend the Peacetime with each other.

CONCLUSION:

Through the design of the PeaceTime concept, we started to investigate alternative approaches for load balancing with a slow energy perspective: to design for non-Resource men, human to human interaction, emotional design, and multimodal and ambient displays. We hope this concept paints a stark contrast to the HEMS and IHD's which present detailed consumption feedback and energy data, and we hope this paper provokes further discussion within the field of Sustainable Interaction Design for how the outlined opportunity spaces might be considered in future designs.

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