Exploring Challenges and Opportunities for Eco-Feedback Technology

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Abstract

This position paper explores challenges and opportunities for eco-feedback technology. Drawing on two design cases, I discuss the importance of supporting active participation as well as the articulation of work in everyday practices to facilitate reduction of consumption.

Author Keywords

Sustainability, practices, articulation of work, engagement

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction

More and more eco-feedback technology is being implemented to support people's self-awareness regarding water, heating or energy consumption. Although eco-feedback technologies have managed to raise awareness (e.g, using visualisations [7]) about consumption, many challenges still remain. For instance, people still experience disengagement using technology [16, 1] as it is difficult to relate the received feedback to everyday practices [6, 18], to actually reduce consumption.

Taking into account the current challenges for Sustainable HCI [15], this paper reflects on the lessons learned from



Figure 1: The EcoBears

two design cases and discusses how they could offer opportunities to: a) promote people's active participation, and b) support people in finding ways to take action drawing insights from a related user community -people engaging in self-care practices in relation to everyday life.

Methodology

Taking a reflective learning approach from design research, I retrospectively analyse two design cases taking them as objects of reflection [9]. The two design cases were purposefully selected due to their relevance to the sustainability issues reported in the last workshop [15] and to get an understanding of what concerns were in play and how the cases could provide insights to Sustainable HCI.

EcoBears: Augmenting Household Appliances Although the HCI community has tried to address sustainability concerns regarding food waste, energy, heating and water usage [15], little attention has been given yet to issues around household appliance waste. Permanent¹ (e.g., refrigerators) and on-off (e.g., TV) appliances are often disposed of when people acquire new ones even if the old appliances still function. In Denmark, the Middelfart recycling station reports refrigerators and flat-screens as the most common appliance waste [12].

Last fall, we started working on a project to explore how adding extensions (with functional and aesthetics features) to existing household appliances can be a more suitable approach to promote the "reuse" and "longevity of use" [2]. Our first household appliance was the refrigerator due to its approximately constant active/reactive power draw, its possible relation to provoke food deterioration and waste, and for being one of the most common (permanent) appliances that becomes waste. The EcoBears [11] were implemented to inform the user about the current temperature inside the fridge through two polar bear modules, a bear cub and its mother (both 3D printed, see Figure 1). When temperature changes inside the fridge, the bear cub senses the change and starts glowing and pulsating with a specific colour (blue, white or red) to communicate the temperature (too low, normal or high) via a wireless network to the mother bear that could be placed anywhere in the home. Regarding people's active participation, EcoBears support the communication of environmental issues in the home [8] as a way to address possible family disengagement issues [16, 1].

MediFrame: Supporting Awareness and Shifting Similarly to sustainability problems, supporting self-care practices in people's everyday life are also "wicked" problems for which there are not optimal solutions. This case shows how relevant work outside Sustainable HCI [15] could provide new insights for shifting consumption. Through iterative prototyping involving different stakeholders, this case ended up with the implementation of MediFrame [4] –a tablet-based web application– that supports older adults in their medication management practices in relation to their everyday life. A particular feature is the Calendar interface that provides an overview of the medication intake in relation to planned everyday activities, highlighting overlaps between those activities that can challenge the intake. MediFrame enables the user to shift the intake by delaying or re-arranging it. according to the situation at hand.

Challenges and Opportunities

Supporting the Articulation of Work in Everyday Practices According to Strauss et al. [17], people engage in articulation work when they have to coordinate all the

¹Household appliances that remain on for 24/7



different activities that take place at specific setting (e.g., hospital/home) in support of a high level goal. Household tasks are often considered invisible work that require extensive planning and communication. Making this work visible through technology provides awareness and supports its coordination [13]. Eco-feedback technology has put little attention not only to the invisible work related to household tasks but also to the work attached to the introduction of technology into everyday life [14].



Drawing on the complexity of supporting self-care practices [4], it is important to consider and understand all the work that has to be done in relation to everyday practices before implementing technology. While at home, older adults operationalize articulation of work in relation to self-care activities while using and configuring technology, making sense of the received feedback, and adapting their everyday practices to perform a specific activity (e.g., medication intake) that has to be done. Similarly, people operationalize the articulation of work in relation to their sustainability intentions in the same way relying on technology, making sense of consumption data and adjusting everyday practices [6, 7, 3, 5]. As everyday practices might affect each other or are non-negotiable [18, 5], one way to deal with this challenge is to support the articulation of work in everyday practices that refers to the planning and coordination of who, what, when, where, and how to perform specific practices.

In particular, calendars have been proposed as artefacts that could aid "energy consumption awareness" [10]. Drawing on lessons learned from MediFrame, a design opportunity could be to explore how to use calendars to support planning and shifting of electricity usage to reduce consumption at on-peak times beyond supporting consumption awareness. Shifting electricity usage to off-peak periods (so-called green hours) are not only associated to individual's motivation but also to the dynamics of everyday practices [5]. Figure 2 illustrates this design opportunity, the EcoCalendar, that provide an overview "at a glance" of everyday activities, activity overlaps and off-peak periods as well as enables the user to adjust and reschedule specific activities.

From Awareness to Active Engagement

Energy literacy plays an important role in sustainable HCI [14]. As many people can get disengaged using eco-feedback technology [1, 16], technology should also promote active participation, engagement and energy literacy. In the EcoBears, participants highlighted how its symbolic, physical and peripheral features could offer opportunities to encourage playful engagement [6] and serve as an educational tool to support the communication of sustainability and climate change issues² within the family, especially with children at home. However, future work should explore how families' appropriation of the EcoBears, in relation to the dynamics of everyday practices [5], might affect the levels of participation and engagement over time.

Ecological Integration

In both cases, participants discussed the possibility of linking the designed prototype with other devices within its artefact ecology (medication management or household appliances). For example, additional cub bears could be attached to other appliances and thus increase the overall awareness. Designing for an ecological use can offer opportunities to facilitate active participation and engagement of feedback technology in relation to the dynamics and elements of everyday practices [5].

 $^{^2 \}mbox{Polar}$ bears are running out of ice and represent one of the most familiar "losers" of global warming

Conclusion

The cases suggest a series of challenges and opportunities that are important to consider when designing eco-feedback technology. To support people's sustainability intentions, the cases suggest to focus on solutions that support active participation and engagement and the articulation of work required to perform everyday practices to reduce consumption.

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