
Participatory Design for Sustainable Campus Living

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Abstract

Participatory design methods have the potential to produce ethical and useful persuasive technologies, particularly in support of environmental sustainability. I present the use and results of ethnographically-inspired methods, Cultural Probes, and the Inspiration Card Workshop to generate concepts for new persuasive technologies for use by a college EcoHouse.

Keywords

Participatory design, persuasive technology, environmental sustainability.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

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General Terms

Design, Human Factors.

Introduction

This paper is concerned with participatory design of persuasive technology, or technology intended to change attitudes and behaviors [5], in support of environmental sustainability. Elsewhere, I have argued that persuasive technology designers should consider methodologies such as participatory design to help meet their ethical responsibility for persuasive intentions and strategies [3]. Moreover, in her analysis of discourses about sustainability in HCI research, Goodman argues that participatory design can help account for stakeholders' differing beliefs about sustainability [9]. In reference to DiSalvo, et al. [4], Goodman explains that participatory design "can help empower potential users to surface, reflect upon, and creatively respond to their own unmet needs" [9]. Yet, both Goodman and I observe that there has been little exploration of this approach.

Here, I discuss the early stages of participatory design with Grinnell College's student EcoHouse. The goal of this project is to implement persuasive technology to support EcoHouse's mission of enacting and promoting environmentally sustainable campus life. I chose to

work with EcoHouse as a group clearly receptive [6] to persuasive technology for environmental sustainability. Moreover, EcoHouse provides an organizational context and physical setting in which to design and deploy new technologies.

This work is guided by three main questions. First, can participatory design methods result in the deployment of effective persuasive technologies? Second, what participatory methods work in this context? And third, how do participants and non-participants relate to the resulting persuasive technology—both the intentions behind it and the strategies it employs? Prior work in this space, though exciting, does not fully address these questions. DiSalvo, et al. [4], focused on participation as empowerment and rhetorical uses of technology. There is no evident intent to deploy and evaluate persuasive technology. Although Miller, Rich, and Davis [14] had this intent and used a participatory approach, the final concept was generated by designers working alone and not through participatory methods. The work presented here is intended to go further in addressing the first two questions, and eventually the third.

I will go on to present the design context in more detail, describe the use of ethnographically-inspired methods, Cultural Probes [8], and the Inspiration Card Workshop [10] to explore the space and generate concepts, and briefly discuss this participatory approach in light of these questions.

Design Context

Grinnell College is a small, residential liberal arts college in the Midwestern United States. The college has three designated *project houses*, student residences awarded through an annual competitive

process. EcoHouse's proposal for the 2009-2010 academic year sets forth not only a broad goal for residents to live sustainably, but also three specific goals, each supported by a committee or "battalion": first, to educate the community through events and workshops; second, to raise a garden and use its produce; third, to collaborate with the college's Facilities Management (FM) unit in testing new resource conservation technologies and practices for possible deployment elsewhere on campus. I chose to approach EcoHouse as an opportunity space, "where many new things are possible but there is no clear requirement" [12], and therefore scoped the design process to initially consider all aspects of EcoHouse's mission.

All ten of EcoHouse's residents for fall 2009 (4 men, 6 women) agreed to participate in this design project. However, one resident left the house and withdrew from the project. The remaining nine residents have all participated to some degree over the semester.

Ethnographically-Inspired Methods

Like many participatory design projects, this project began with ethnographically-inspired methods. I interviewed participants to learn their motivations and concerns for living in EcoHouse, their relation to its mission, and their comfort with potential technology channels such as Facebook and text messaging. I obtained key documents such as EcoHouse's lifestyle guidelines and the aforementioned proposal. Finally, I have acted as a participant-observer in EcoHouse's Sunday dinner meetings throughout the semester, and also FM committee meetings later in the semester. Participant-observation has helped me understand the house's procedures, concerns, and social dynamics.



Figure 1: The probes package used an aesthetic of reused materials, in keeping with the environmental focus.

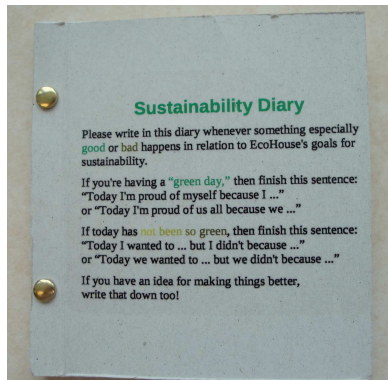


Figure 2: The Sustainability Diary probe directs participants to record green acts they are proud of, and things they wish they had done differently.

These methods also let me learn about persuasive technology already in use at EcoHouse. Most relevant here is an energy and water monitoring system installed last year, in part to provide residents with feedback on resource consumption. This system has been a mixed success. On one hand, the system is hard to use, inaccessible, and unsuited to providing real-time feedback. Some residents described the system as a mysterious thing lurking in the basement. On the other hand, members of the FM committee figured out how to put the data into a spreadsheet and produce monthly and daily trend graphs. They have used this information to identify functions with high resource consumption (heating, showering, and cooking) as targets for behavior change, and to seek explanations and assign responsibility when consumption was unusually high.

Cultural Probes

Beyond my own analysis of the site, I wanted to engage participants as active partners in exploring and representing the design context. However, participatory methods for exploring workplace tasks seemed unsuited to this non-task-oriented, home setting. Instead, I designed a probes package. As originally conceived by Gaver, Dunne, and Pacenti [8], cultural probes are packages of physical materials, such as cameras, maps, and postcards, designed to evoke ambiguous glimpses of potential users' lives. However, my use of probes here was less concerned with probes' inspirational qualities and more with their potential as a means of participation [2].

The probes package (figure 1) included several cards with questions and images intended to provoke visual or metaphorical thinking; cards offering “three wishes” for new technologies for EcoHouse [1]; a disposable

camera with photo prompts such as “something green” and “a guilty pleasure”; house floorplans to annotate; and a Sustainability Diary asking participants to document critical incidents (figure 2). I delivered the probes package at the house's second weekly meeting, stressing the opportunity for fun and reflection, as well as generating inspiration for the design work to come. The probes display remained for four weeks in a visible location in EcoHouse's living room.

Participants completed most of the materials. The package as a whole and even some individual items showed evidence of multiple contributors. Participants' enjoyment was apparent in some elaborate responses. The probes allowed participants to tell stories about comfort and sacrifice, purchasing decisions, and work in the garden. They expressed frustration with inefficient appliances, undone chores, and wasted food. There were some surprises, including an unsolicited analysis of paths to sustainable and unsustainable decisions. Their words poignantly portrayed their belief in a supportive community working together and their uncertainty about what to do next.

Inspiration Card Workshops

To bridge the gap from analysis and reflection to design, I applied the Inspiration Card Workshop method developed by Halskov and Dalsgård [10]. As suggested by the name, the workshop centers on Inspiration Cards, tangible materials to support participants in making design moves. These fall into two categories: Domain Cards and Technology Cards (figures 3 and 4). During the workshop, participants and designers combine selected cards to form new design concepts. Below, I discuss in more detail the Domain and Technology Cards, the workshop itself, and its results.



Figure 3: The Technology Cards include the *Virtual Polar Bear* [7], *One Million Acts of Green* (<http://www.cbc.ca/green/>), and *Infotropism* [11] (shown front and back).



Figure 4: The Domain Cards include *Comfort*, *Waste*, and *A Supportive Community* (shown front and back).

Domain Cards represent concepts from the design domain: in this case, EcoHouse. The workshop used 27 Domain Cards in all; figure 3 shows three examples. The front of each Domain Card shows a title and an evocative image, while the back uses text to further evoke or exemplify the concept. I developed candidate Domain Cards based on interview transcripts, my observations, and the Cultural Probes. Review of the candidate concepts with four participants reduced the 55 candidates to the final 27 concepts, including ten that were significantly changed and two that were entirely new. Many concepts are illustrated by photos from the Cultural Probes or from a tour of the house, and the remainder by stock photos. For most cards, I was able to draw text from EcoHouse documents, interview transcripts, or Cultural Probes.

Technology Cards depict inspirational technologies, to suggest a range of technological possibilities. The front of each card includes an image and the name of the technology, while the back gives a description along with a URL or citation. The workshop used a total of 18 Technology Cards; three examples are shown in figure 4. In selecting the Technology Cards, I considered Fogg's recommendation to work from example persuasive technologies that share an audience, technology channel, and/or behavior with the design problem at hand [6]. Thus, I included persuasive technologies for college students and for use in the home. Based on the interviews, I concluded that using an ambient display or a web site as the technology channel would be most comfortable for participants, and chose examples of such. Drawing in part on Zapico, Turpeinen, and Brandt's survey of "climate persuasive services" [16], I also included a range of persuasive technologies concerned with sustainability.

The Inspiration Cards served as the basis for two, two-hour workshops on consecutive Saturdays, one with four participants and the other with three. After I introduced the agenda and the goal for the workshop—to generate ideas for new technologies in support of EcoHouse's mission of promoting sustainable living—one of the participants who had earlier reviewed the Domain Cards introduced them to the group. Then, I presented the Technology Cards. While the domain concepts were familiar to participants, the technologies were unfamiliar and required more explanation. Next, we moved into the Combination and Co-Creation phase. I explained that participants could combine any cards to create a new design concept. To represent the concept they should tape the cards to a poster and use markers to write or draw further explanations. Blank cards were available to introduce further technologies or domain concepts. At the end of the workshop, participants explained their concepts to me and to each other.

The participants produced posters portraying a total of 26 distinct design concepts, 14 in the first workshop and 12 in the second workshop. Two high-level ideas appeared in both workshops: frequent and visible feedback on resource consumption, and creating a web site to connect Grinnell's EcoHouse with ecologically-focused houses and dormitories on other campuses.

All of the design concepts are persuasive technologies in that they reflect an intent to increase either some particular behavior or more sustainable practices in general. All but two of the concepts are related to EcoHouse's mission. The concepts strongly reflect the Technology Cards in their targeted behaviors, technology channels, and persuasive strategies. As Halskov and Dalsgård also observed [10], many design

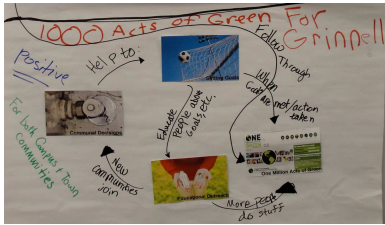


Figure 5: This Inspiration Card poster, for the design concept "1000 Acts of Green for Grinnell", combines three Domain Cards with one Technology Card.

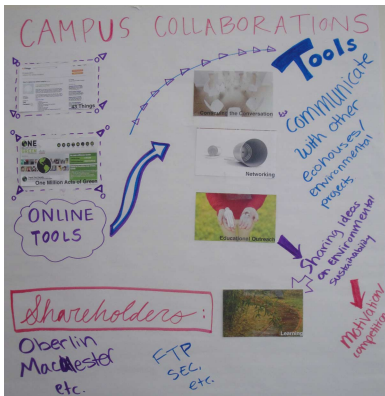


Figure 6: This Inspiration Card poster depicts "online tools" to "communicate with other ecohouses" and mentions "sharing ideas", "motivation", and "competition."

concepts were minimal modifications of a depicted technology to fit the new domain context. For example, "1000 Acts of Green for Grinnell" combines *One Million Acts of Green* (<http://www.cbc.ca/green/>), a campaign to aggregate many individuals' acts for sustainability, with the domain concepts *Goal Setting*, *Communal Decisions*, and *Educational Outreach* (figure 5). However, other ideas were more innovative in their combinations: for example, combining the domain concepts of *Energy* and *Cooking and Eating* with the *Breakaway* [14] technology to produce an ambient display visualizing the stove's residual heat after being turned off, as a suggestion to cook or bake while the heat remains. Participants also introduced technologies from their own experiences: everyday technologies such as email, but also heat-sensitive mugs, museum exhibits on food storage, and hotel rooms that require a room key to turn the lights on.

Continuing Design Process

At the two weekly meetings following the Inspiration Card Workshops, participants presented their design concepts to each other and identified the ideas they thought would best support EcoHouse's mission. Three design directions emerged as of broad interest.

The first, dubbed *Campus Connections* (figure 6), is a web site to connect college houses and dormitories with missions similar to Grinnell's EcoHouse. The idea is not only to promote collaboration and socialization across campuses, but also to promote sustainable behavior through the strategies of persuasive social media, such as social facilitation or public goal-setting, normative influence, social comparison, and social learning [16]. Design on *Campus Connections* has continued through a participatory elicitation of "stories" or brief scenarios

describing possible site functions, and a review of five related web sites. Currently, participants are contacting students in 3-5 similar houses at other campuses, to expand the scope of participation.

A second theme was to more effectively use energy and water meter data by making feedback more frequent and visible, through ambient displays in EcoHouse or the campus intranet, similar to approaches pioneered at Oberlin College [15]. I am exploring technological options for accessing the data, and plan to participatively prototype displays in the spring.

Finally, several participants were excited by an idea for a new technology policy: Give each student a power strip to let them more easily cut off inessential appliances and thus reduce electricity use. But, another participant pointed out that the policy could backfire if students plug in more devices and leave the power strips on. Discussion thus turned towards systems that would let residents choose devices to be automatically controlled based on sensors. I am currently exploring off-the-shelf automation systems so that participants can gain concrete experience with related technologies.

Discussion

As yet, this work cannot fully address the three questions posed in the introduction. Ideas generated by participants have not yet been implemented, deployed, and evaluated. However, the work thus far shows that the Inspiration Card Workshop, supported by ethnographically-inspired methods and Cultural Probes, can enable participants to reflect on their behaviors and generate concepts for persuasive technologies for their own use. Although some concepts are novel, many strongly reflect the input technologies selected by the

designer. The method seems to encourage participants to focus on persuasive technologies, and may even lead participants to persuasive strategies that have been shown to work. Indeed, Fogg recommends that new persuasive technology designers begin by imitating successful examples [6]. Finally, even if some design concepts are not novel, a participatory design process may help identify existing tools that support behavior changes that participants truly desire.

However, this paper explores only one approach. Could a participatory adaptation of Fogg's 8-step process lead to more effective persuasive technologies? Or could an entirely different process lead to more novel designs?

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