

# Motivating Environmentally Sustainable Behavior Changes with a Virtual Polar Bear

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## Abstract

*Personal choices and activities account directly for much of the energy consumption in the U.S. with secondary impacts of those activities influencing an even larger proportion of energy consumption. Although there is a long history of investigation into motivators for energy-conservation, it is still unclear how to encourage persistent behavior change, and technology has only recently been applied to the problem. We sought to learn if virtual pets could have a positive impact on real-world, environmentally responsible behavior. The polar bear is a powerful iconic symbol for many individuals, and its fate can be simply and directly connected to environmentally responsible behavior. Just as Tamagotchis evoked a powerful response from their owners, we hoped to use attachment to a virtual polar bear as a motivator for energy conservation. We ran a study exploring the impact of attachment on real-world actions. The results of our study suggest that an interactive virtual polar bear may increase environmentally responsible behaviors, especially when emotional attachment takes place.*

## 1. Introduction

According to the U.S. Department of Energy, Americans consumed 100 quadrillion BTUs of energy in 2005 [12], with personal, individual activities accounting for much of this consumption. For example, 40% of the energy consumed is used for residential or commercial lighting, heating and cooling. All of this is driven directly by individual choices or indirectly because of consumer needs. Thus, personal choices can lead to a significant reduction in energy consumption, with a corresponding reduction in the release of CO<sub>2</sub>, one of the primary gases assumed responsible for climate change. However, this requires persuading individuals to change their behavior, and maintain those changes over time, both difficult propositions. Our approach is to leverage the power of the polar bear as a symbol of climate change by creating a virtual pet, a technology that has promise for supporting behavior change (e.g. [8]). We describe a pilot study showing that increased attachment to a virtual polar bear had a significant positive impact on the number of actions that individuals had taken as reported a week after they used our software. This work is currently being incorporated into a mobile tool intended to influence transportation choices and into a social networking website.

There is extensive literature in the areas of environmental sociology, public policy, and more recently, conservation psychology that discusses the promotion of environmentally responsible behavior. In past work, we have explored the impact of motivators such as public commitment,

frequent feedback, and personalization on environmentally responsible behavior [11]. Research in conservation psychology implies that animals help humans connect with nature [10]. Vining’s literature review demonstrates the extensive evidence for strong emotional bonds between humans and animals but she states that the answer to whether caring about animals or the environment leads to environmentally responsible behavior remains open [12]. Technology may provide a mechanism for leveraging these bonds to encourage behavior change. For example, Tamagotchis are virtual pets requiring nurturing interaction in order to be sustained. This in turn led to an emotional attachment to these virtual pets, for example owners mourned when their pets “died” [3]. Lin and Strub’s “Fish’n’Steps” study is an example of how an interactive computer game using a virtual pet, in this case fish, encourage physical activity [8].

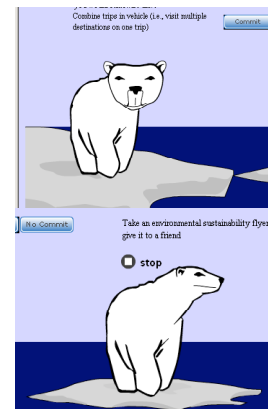
Our approach integrates conservation psychology with persuasive technology, the study of how computers can leverage psychological cues to motivate and influence behavior [4]. For example, motivators of environmentally responsible behavior are more effective when they have a direct impact on people’s needs or concerns [2]. Also, caring for *real* animals can inspire conservation behavior [12]. In this paper we show that an emotional connection to a *virtual* pet that responds to environmental behavior can help motivate an individual by making that behavior seem to directly impact an individual’s concerns.

## 2. Experiment

We conducted a one week, between subjects study comparing environmentally responsible behavior in participants with higher attachment to a virtual pet (the *attachment group*) and participants with lower attachment to the same pet (the *control group*). Participants were shown a Flash-based virtual polar bear on an ice floe that would react to a their commitment to environmental actions. As shown in Figure 1, the size of the ice floe would change depending on the number of actions a subject committed to taking. Our study tested the following hypotheses:

- H<sub>1</sub>: Commitments - Users who form emotional attachment to the virtual polar bear will commit to more environmentally responsible actions than users who do not form bonds
- H<sub>2</sub>: Fulfilled Commitments - Users who form emotional attachment to the virtual polar bear will fulfill (act on) their commitments
- H<sub>3</sub>: Donations - Users who form emotional attachment to the virtual polar bear will donate more to a zoo than those from the control group

We recruited 20 subjects (10 in each condition) associated with Carnegie Mellon and local universities from the Center for Behavior Design Research. Participants were given \$15 and a shower timer for their time. All participants completed an initial survey at the start of the experiment to test whether either group was more likely to have higher motives for environmentally responsible behavior and whether this changed during the experiment. We used



**Figure 1:** (top) a polar bear with lots of ice (bottom) a polar bear with little ice

a subset of questions from De Young's scales measuring competence and participation [2]. Participants also completed two additional scales both before and after the main intervention (viewing the polar bear): the first measured levels of care on agreeableness and empathy [6] and the second measured overall environmental concerns [7]. All scales had a reliability of .65 or higher, measured using Cronbach's  $\alpha$  (values were  $\alpha=.8615$  for competence,  $\alpha=.8920$  for participation,  $\alpha=.7579$  for care and  $\alpha=.655$  for environmental concern).

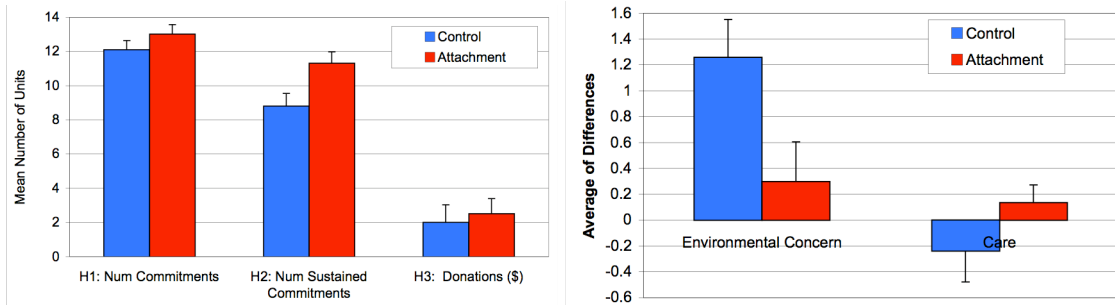
Next, both the attachment and control group were asked to read a factual story describing environmental change, specifically the impact of climate change on the habitat of polar bears. Participants in the attachment group received an additional paragraph with further details on how shrinking ice floes impact polar bears' search for food and threatens their overall existence, pre-tested to elicit sadness from readers. They were also asked to consider their emotions after reading the story, name the polar bear, and write a description of environmental responsibility. After this preparation, participants from both groups were shown a list of fifteen actions promoting environmental sustainability and given the opportunity to commit to any number of them. Each time the user made a commitment, the polar bear's ice floe would increase in size and the polar bear's affect would become less negative.

All fifteen actions were chosen to represent a range of difficulty of execution. Fourteen were taken from sixty actions previously designed and tested as part of a field study of the StepGreen website [11]. Examples included "Take the stairs instead of the elevator" and "Restrict length of shower to five minutes or less" (recall that participants were given a shower timer). We also created an additional action, "Take an environmental sustainability flyer and give it to a friend," and made flyers available to participants.

Two days after the study, we called participants and asked if they would pledge any of the money earned from the experiment to the zoo's polar bear exhibit (in which case we sent them a pledge envelope). We successfully reached 6 participants in the control group and 8 participants in the attachment group within  $\approx 2$ -5 days. A week after the study, we asked which of their committed actions they had completed. We successfully reached 5 participants in the control group and 6 participants in the attachment group within 7-13 days.

### **3. Results and Discussion**

Out of the 20 participants, one participant from the attachment group did not complete all requested tasks and was not included in our analysis. Of the 19 left, 60% were male and 40% female; 95% of the participants were students. Motivation for environmentally responsible behavior was balanced across the groups, according to the initial survey ( $p=.08833$  and  $.08199$ ).



**Figure 2:** (left) The attachment group was higher for all hypotheses, and H<sub>2</sub> (Fulfilled Commitments) is significant ( $F[1,11]=6.572$ ,  $p=.0309$ ). (right) The attachment group exhibits greater environmental concern and caring for the environment after reading about and interacting with the polar bear ( $F[1,19]=5.1273$ ,  $p=0.0369$  and  $F[1,19]=3.8124$ ,  $p=.0675$ , respectively). Note that the environmental concern scale is reversed, so the attachment group's lower score indicates higher environmental concern).

As shown in Figure 2 (left), participants in the attachment group had a higher mean number of committed actions (H<sub>1</sub>), fulfilled commitments (H<sub>2</sub>) and a higher mean donation (H<sub>3</sub>). Of these, the difference in fulfilled commitments was statistically significant:  $F[1,11]=6.527$ ,  $p=.0309^*$  and the difference in donation amount was almost significant ( $F[1, 19]=3.8124$ ,  $p=.0675$ ). Only the difference in committed actions was insignificant ( $F[1, 19]=1.3908$ ,  $p=.2545$ ). Additionally, the attachment group demonstrated significantly greater environmental concern and greater care after reading about and interacting with the polar bear, as shown in Figure 2 (right). ( $F[1,19]=5.1273$ ,  $p=0.0369$  and  $F[1,19]=3.8124$ ,  $p=.0675$ , respectively).

Our findings demonstrate that participants in the attachment group were more concerned about the environment, and this translated directly into significantly higher reported actions. Of particular interest is the fact that while number of commitments was not different between the groups, reported follow through in terms of fulfilling those commitments was significantly higher. It is possible that participants in the attachment group lied about doing more out of guilt or some other emotion. Also, we do not know how long these differences would be sustained for.

#### 4. Future Work

Our next step is to deploy the polar bear over a longer period of time, in a setting where we can objectively measure its impact on action. This addresses the two biggest concerns mentioned above. We plan to deploy the polar bear on a mobile platform that can track use of different transportation options. Additionally, we are currently creating a virtual polar bear plugin for MySpace and Facebook. The large numbers of users on sites such as MySpace (used by over 61.2 million unique visitors) and Facebook (over 19.5 million unique users)[9] presents exciting opportunities to encourage personally- and socially-desirable change in behaviors. Users will be able to publicly make commitments and have the status of their polar bear on display. Based on consistency theory, users would be more likely to behave consistently with their commitment [5]. This may also lead to further research on the impact peer pressure may have on environmentally sustainable actions.

## 5. Reason for Attending

The work we described is an initial contribution to the issue of persuading individuals to take more sustainable actions. As such, it addresses one of the three main topics of the workshop, how to motivate sustainable action. Additionally, though there was no room to discuss it here, our research is expanding to address the appropriate deployment platforms and messaging for varied socio-economic and ethnic groups. We are excited by the opportunity to attend this workshop and engage researchers on these critical fronts.

## 6. Author Bios

**Tawanna Dillahunt** is a first year Ph.D. student at Carnegie Mellon University. Her research interests include environmental sustainability and pervasive computing.

**Geof Becker** works at the Tepper School of Business at Carnegie Mellon in Marketing and Public Relations and is interested in encouraging development of online communities that commit to positive social action.

**Jennifer Mankoff** is an assistant professor at CMU in the HCII. Her research interests include environmental sustainability, pervasive computing, and Assistive Technologies.

**Robert Kraut** is a Herbert A. Simon Professor of HCI at CMU. He conducts research in four major areas: online communities, everyday use of the Internet, Technology and conversation, collaboration in small work groups, and computers in organizations.

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