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# Power Ballads: Deploying Aversive Energy Feedback in Social Media

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**Abstract**

This paper reports on the pilot evaluation of “Power Ballads”, an evocative social media application which displays aversive feedback based on excessive household energy usage. Work by other researchers in persuasive technologies has previously suggested the use of aversive feedback should be avoided as it leads to a lack of engagement by users. This work evaluates whether punishment of non-desirable behaviour discourages users from engaging with a persuasive application. To this end we recruited 9 households to use the Power Ballads application over a period of 4 weeks. We found the use of aversive feedback did not act as a deterrent to regularly interacting with the application through evaluating user engagement.

**Keywords**

Energy Saving, Persuasive Technology, Sustainability, Social Networks, Aversive Feedback, Motivation

**ACM Classification Keywords**

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. J.4. Social and Behavioural Sciences: Psychology

**General Terms**

Design, Experimentation, Human Factors

## Introduction

Recent interest in the use of persuasive technologies [10] has produced a range of interactive interventions designed to change behaviours in areas such as health [3] and sustainability [11][15]. However, very few such studies have identified, in detail, the reasoning behind their selected behavioural change mechanisms or the cognitive processes that their users are expected to experience.

Froehlich *et al* [12] recently undertook a comparative review of papers generated by both the environmental psychology and HCI communities which used persuasive technologies and stressed the need for HCI researchers to collaborate with environmental psychologists in order to leverage their expertise when attempting to change target behaviour. This suggests that the persuasive technologies that are being developed by the HCI community would benefit from a fuller understanding of psychological behaviour change strategies.

Persuasive technologies have typically aimed to motivate behaviour change primarily through presenting positive feedback when the desired behaviour is observed [5][2]. Indeed, well known recent literature by the HCI community [6][1] specifically recommends that only good behaviour is rewarded, thus offering no consequences when users do not meet their goals. Interestingly, this is in sharp contrast with the findings from applied psychology, where it is suggested that corrective feedback – i.e. presenting consequences regardless of the behaviour observed – is often the optimum approach [13]. Furthermore, our own recent work has discussed how

playful aversive feedback can be harnessed to reduce energy consumption in the kitchen environment [14].

Those who suggest that aversive feedback is not appropriate for online behaviour-change interventions [6][1] often refer to the problem of users becoming disengaged when punishment is delivered. It is argued that the easiest way for a user to avoid punishment in such an application is to stop using the application, rather than changing their behaviour. It is important to realise that this is an assumption rather than an empirical finding.

In this work-in-progress we investigate whether playful aversive stimuli can function as an integral part of an application designed to help users monitor and reduce their domestic energy consumption.

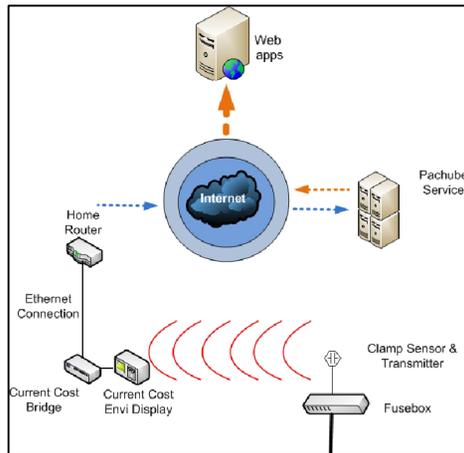
## Application Design

We have devised an application that promotes behaviour change primarily through playful aversive feedback. The Power Ballads Facebook application used in this pilot study is a simple, early prototype. A basic interface was developed that delivered feedback on participant's comparative energy by time splicing the previous 48 hours of usage. A commercial off-the-shelf home energy monitoring system from the company Current Cost – consisting of an ENVI display and Bridge [7] – was used to connect energy data to the Power Ballads application.

When a user visits the Power Ballads application from their Facebook account, the interface informs them of their energy usage by means of a large notification displaying 'Yes!' if they have saved energy or 'No!' if they have increased their usage, as shown, for



**Figure 1.** Power Ballads notification interfaces for energy usage



**Figure 3.** Technical implementation of Power Ballads

example, in figure 1. If the user increases their energy usage then they are effectively punished by the application automatically publishing aversive feedback in the form of a public post to their Facebook newsfeed. This posted message would then be viewable by their Facebook friends. The post highlighted they were using more energy over the past 24 hours compared to the previous 24 hours, effectively disclosing their high usage, or undesirable behaviour, to their friends.

As energy consumption is an important issue in domestic households, it was apparent that the publishing of aversive feedback about excessive usage on participants' Facebook page may be undesirable and could lead to the type of disengagement discussed in [6][1]. We were interested in exploring whether presenting this information in a playful manner may avoid the problem of disengagement. To this end, we chose to present popular UK chart music as the aversive stimuli posted on participants Facebook wall. Participants were initially screened and accepted based on their strong disliking for this type of modern chart music. An example of a feedback post is shown in figure 2, complete with comments added by the user and their Facebook friends.

### Implementation

Our software implementation utilises both the Facebook Graph and Pachube API's [9][4] to display participants live online energy data on the Facebook platform. The Current Cost Energy Bridge and Envi display were the selected home energy monitor components for the study. The energy bridge provides the capability to send energy data directly online to the Pachube service via a home router. Figure 3 illustrates the technical implementation of Power Ballads.



**Figure 2.** Anonymised example of an aversive feedback post

Pachube is a data brokerage store for the 'internet of things' and provides an online REST API that allows authorised web applications to query sensor data. This is an important step forward in the evolution of home energy monitoring as most monitors to date require PC software (with powered on PC) to send energy data online where it can be used by third party applications. By using cutting edge hardware the process of monitoring is more transparent to the end user by sending energy data directly online, increasing the user experience quality and saving energy.

### Experimental Method

#### Aims

The aims of the study were twofold: 1) To investigate the effectiveness of aversive feedback to *engage* users in eco-feedback applications and 2) Analyse user comments generated from the aversive feedback posts for emergent themes that could then be exploited in subsequent eco-feedback applications.

### *Participants*

Using a mixture of purposive and convenience sampling, nine lead participants were recruited: 4 of which were female, from nine households.

### *Design*

Each household was given an energy monitor for a period of 5 weeks. At the end of the first week participants were given access to the Power Ballads application on Facebook and could then view their previous 24 hour energy usage in graph form and view energy notifications based on whether or not they are saving energy in the previous 48 hour period. In order to view Power Ballads each participant was required to first login to Facebook and start the application. Aversive feedback would only be delivered when logged in giving the opportunity to examine whether participants were engaging with the application or simply avoiding punishment by not using it. A short end-of-study qualitative questionnaire was also completed to elicit participants' subjective experience of interacting with Power Ballads.

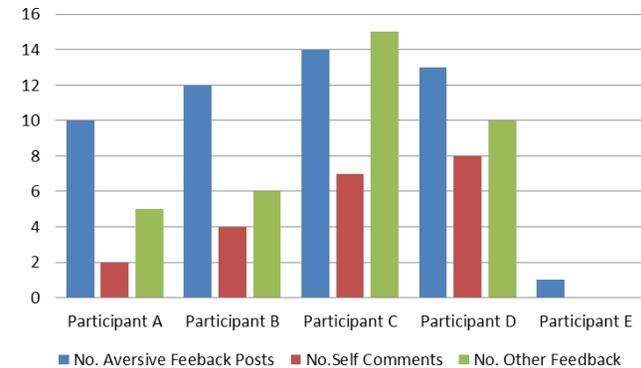
### **Results**

During the course of the study 5 participants actively used Power Ballads, 1 participant did not realise they had to log into the application to view feedback and 3 had compatibility problems with their home routers in recording their home energy data. Thus, the data from five of the nine original participants is presented here.

In total, 167 visits (75% in the first two weeks) were made to the application with 50 aversive newsfeed items posted to the participants Facebook wall. This equates to around 30% of all visits to the application resulting in a punishment post with the remaining 70%

bringing about a notification indicating they were saving energy. It highlights participants were engaging with the application by logging in and therefore not trying to avoid punishment. From the 50 aversive newsfeed posts an additional total of 57 user-generated content items were created consisting of 41 comments and 16 'Like' clicks suggesting that playful dialogue took place. These user generated items were created by participants and non-participants who were Facebook friends. Additionally, 5 questionnaires were completed from all active users of Power Ballads.

Figure 4 highlights participant engagement throughout the study. The graph illustrates the number of times an aversive post was created for each participant and the number of times overall they responded via comments to their own posts. Also shown is the total number of other feedback items including comments and 'Like' clicks from other participants and Facebook users. The results show that participants engaged with their own and others' aversive feedback.



**Figure 4.** Participant engagement with aversive feedback

## Discussion

With the results suggesting that aversive feedback may be effective in successfully engaging users (or at least does not disengage users), it is worthwhile to look at some of the user-generated comments that were created based on the aversive newsfeed posts.

Engagement on energy usage was present, **Participant C**: "277...are you sat in the dark?" with **Participant B** responding with: "is 277 fairly low? It is not extremely bright in here, but still can recognise furniture and Aga!" Similarly, another dialogue, **Participant C**: "313 average and you have used more today? Did you sit in the house with the lights off yesterday?" with **Participant D** responding: "Yesterday it was 233 and that was higher than before that! Not sure what's been different today though."

Interestingly, some of the dialogue was based on determining which appliances may be causing the aversive feedback, **Participant D**: "You're using the most out of Juliet you and me today! Washing day?!" with **Participant A** responding, "Funnily enough yeah...the washing machine, caught up on a load of washing!! Just shows you". **Participant D** responded directly to the aversive feedback when their personal usage peaked at its maximum with "Oh good god! I guess that's what i get for having the oven on :( ....but i also get home-made bread...not sure it's worth my reputation though!!"

Engagement surrounding the use of chart music as aversive feedback was also present, **Non-participant**: "jls???" [teenage boy band] with **Participant D** responding: "There needs to be a smiley for hanging your head in shame!!". Additionally, the quote, "Oh no,

what are you doing to my reputation!" by **Participant C** was a direct response to an aversive feedback post.

Due to insufficient space we are unable to present a fuller breakdown of all the comments. However, the majority of comments were centred on two themes, the first based around energy usage and the appliances potentially responsible for causing the aversive feedback. The second theme focused around friendly banter related to the chart music used in the newsfeed posts. These two emergent themes were mirrored in our questionnaire data.

## Conclusions and Further Work

The wider goal of this study was to evaluate whether punishment of non-desirable behaviour can function as a useful part of larger future studies. It is apparent that this type of feedback does not necessarily lead to disengagement by users if presented carefully. We do not suggest that presenting only aversive feedback is an ideal method of designing a persuasive application; indeed our questionnaire data revealed that participants A and C would have liked supplementary reward posts when saving energy. However, we have demonstrated that aversive stimuli do not necessarily bring about disengagement. Rather, as the psychology literature suggests that aversive stimuli can function as a valuable component in behaviour change interventions. We have demonstrated that it does not necessarily lead to participant disengagement, and therefore conclude that it is important that this type of feedback should not be simply ignored when designing persuasive applications, as has been suggested by other researchers.

A common criticism levelled at technology-centric sustainability interventions is that they use non sustainable resources themselves. Furthermore, many persuasive technology studies that are designed to motivate reduction in energy use have been shown to be successful in the interim. Despite this, more often than not they tend to require feedback to be delivered permanently, albeit at a lower frequency over a prolonged duration [8]. It could be argued that technology-enabled interventions which incorporate traditional and empirically proven behaviour change methodologies (as described in this work-in-progress), could eliminate the need for consistent and permanent feedback to be delivered if the target behaviour has been adopted.

This was a small scale pilot study and only a larger investigation could conclusively determine how effective aversive feedback may be when used in the context of changing behaviour in energy consumption. Building on our findings, we plan to run a longitudinal energy study deploying aversive feedback with a view to evaluating potential behaviour change in energy consumption. The evaluation would test whether aversive stimuli, chart music and exposing undesirable consumption in this case, could actually function as a punisher to motivate reductions in energy usage as a result of the feedback.

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