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Engaging Energy Saving through Motivation-Specific Social Comparison

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Abstract

Comparison is widely used in research projects and commercial products whose goal is to motivate energy saving at home. This research builds on fundamental theories from social psychology in an attempt to shed light on how to motivate consumers to conserve energy by providing relevant people for social comparison depending on consumer's motivation to compare. To support the research process, the mobile application EnergyWiz was developed through a theory-driven design approach. Along with other features EnergyWiz provides users with three types of social comparison – normative, one-on-one and ranking. The results of interviews with prospective users are used to derive design suggestions for relevant people for comparison (comparison subjects).

Keywords

Persuasive Technology, Sustainable HCI, Comparative Feedback, Social Networking, Energy Monitoring

ACM Classification Keywords

H.5.2 User Interfaces: User-centered design.

Introduction

Scientists describe climate change unequivocally as reality and very likely due to anthropogenic greenhouse

emissions [13]. In Australia, for example, a significant contributor to these emissions is the residential sector which constitutes 12% of the total Australian energy consumption and has seen a 100% increase since the beginning of the 1990s [4].

A promising approach to mitigate the human impact on the environment is to change attitudes and behaviours through persuasion and tapping social influence [7]. Applications using persuasive technology benefit greatly from the development of energy monitors, but many of them that motivate energy saving do not take the motivation of the particular user into consideration, especially during the design phase [12].

This paper addresses this research gap by deriving motivation-specific design suggestions for comparative feedback. More specifically, it elaborates on finding relevant comparison subjects based on semi-structured interviews with prospective users interpreted through models from social psychology.

Related Research

In the field of energy saving, persuasive applications employ various persuasive techniques to motivate behaviour change, such as pertinent information, goal setting, feedback and comparison [10]. We will focus on the last two since they are employed in the majority of the commercial energy monitors nowadays.

Feedback

Feedback is information that provides a basic mechanism with which to monitor and compare behaviour, and allows individuals better evaluate their performance. It is one of the most effective strategies in reducing energy consumption at home [9] and can lead to up to 15% in energy savings [3].

Comparison

Comparison can be temporal – contrasting one's achievements to past performance, or social – comparing them to those of others. Social comparative feedback (i.e., the feedback that contains social comparison) is a significant factor for promoting behaviour change in the area of energy conservation. It is fostered by the rise of online social networking sites, which are a rich source for relevant comparison subjects and provide new opportunities for communicating energy-related feedback [8, 14].

Social Comparison

Social comparison is constituted in the internal human drive to evaluate one's opinions and abilities. In the absence of an objective means to evaluate one's abilities, people evaluate them through comparison with the abilities of others, whereby the tendency to compare oneself with another person decreases as the difference between their abilities increases [5]. In the context of energy conservation, social comparison may be especially effective when relevant others are chosen as comparison subjects [1]. This research focuses on three types of social comparative feedback: normative, one-on-one and ranking.

Normative comparison is a type of social comparison in which an individual or a group is compared to the (statistically) averaged performance of a group of subjects. When contextualised, it was successful in motivating people to behave in an environmentally conscious manner [11]. In addition, adding a message of social approval or disapproval [16] was

demonstrated to keep those performing well motivated when leading.

In contrast to normative comparison, one-on-one is a direct comparison involving two individuals whereby the emphasis is on its personal contextualised nature. This comparison has been shown to be effective when comparison subjects are known [17]. Similarly, comparison through ranking was successfully employed in a campus energy saving challenge [15]. However both of these comparative feedback types were not extensively explored in the context of energy saving.

Through the proposed EnergyWiz application, this research project addresses a gap in current research providing design suggestions for comparison subjects based on users' motivations for comparison.

Methodology

The first step towards exploring the research question was to design and develop the EnergyWiz application through a theory-driven design approach [2] which is described in detail in the next section.

Following the development activities, we organised personal, semi-structured interviews with 17 prospective EnergyWiz users. 14 of them were male and 15 of them between 25 and 34 years old. The rest were either slightly younger, or slightly older. The majority – 14 were full-time employees and the remaining full-time university students.

The interview process was two-fold: First we conducted an application walkthrough with each participant by giving them meaningful tasks in the form of scenarios. Once the users were introduced to the fully functional version of EnergyWiz complete with real data, the individual interviews took place. Interviewees shared what motivated them to compare with others and their experience in energy conservation at home. Once a detailed picture of these characteristics was available, we proceeded with a systematic review of each comparative feedback type and gathered the users' feedback on each of them.

After the interviews, the qualitative data was evaluated, whereby we searched for recurring relationship patterns between user motivations for comparison (among benchmarking [5], learning and self-enhancement [5] and competition [6]) and their preferences for comparison subjects in the respective comparative feedback types.

Application Design

Well-established theoretical knowledge from social psychology and the related research findings reviewed above have been incorporated to design and build a high fidelity prototype corresponding to the best practices and thus to allow the users to concentrate on the motivation-specific part of the design. Hereby the development process approach is known as theory-driven design [2].

The application consists of five main features: Live Data, History, Neighbours, Challenge and Ranking (Figure 1 left). Since the last three have a social element (thus contain comparison subject), we will focus them.

The Neighbours feature depicts a normative comparison and lets the user compare with the averaged performance of two groups of neighbours – efficient

and inefficient. Depending on user performance, EnergyWiz displays a visual and textual message of social approval or disapproval (Figure 1 right).
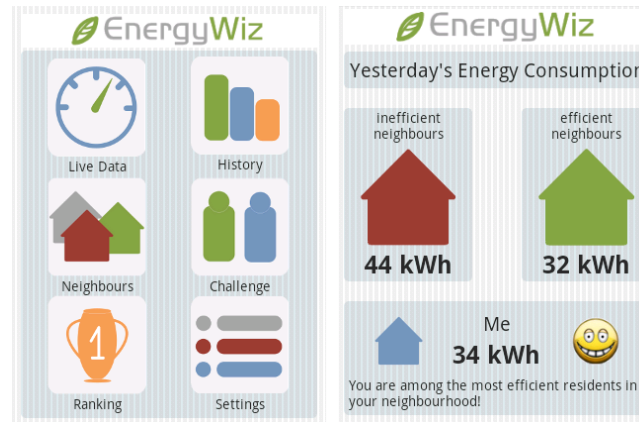

figure 1. Main Menu (left), Neighbours (right)

One-on-one comparison is represented by a challenge between two friends on the online social networking site Facebook who compare their energy consumption during a week (Figure 2 left). The current score can be shared through a wall post on Facebook.

The last social comparative feedback included is the ranking which orders EnergyWiz users with similar relevant attributes, such as household size and residence type (Figure 2 right). The ranking is shared with a dedicated Facebook group uniting users.

Results

According to the users the motivation for benchmarking was only partly supported by the Neighbours feature. While some claimed that their neighbourhood is homogenous and people are similar, others noted that similarity should be ensured. In contrast to these views, an interviewee suggested using standard, averaged values for different domestic chores, such as laundry. Furthermore, the Challenge feature was not relevant for benchmarking according to the users because most friends are dissimilar concerning their energy consumption. The Ranking feature was partly suitable but interviewees were concerned about the different experience levels among the ranked users.
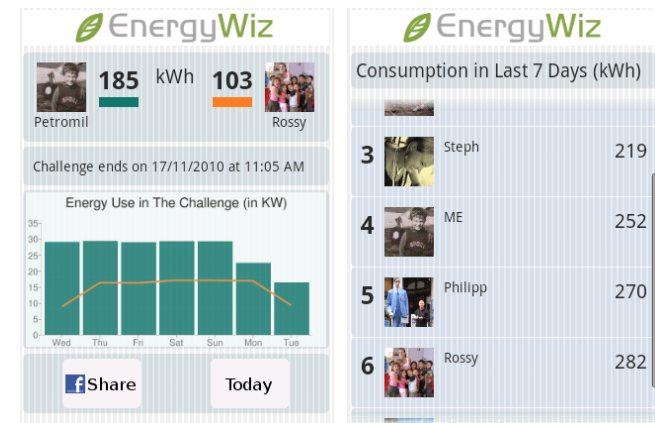
figure 2. Challenge (left), Ranking (right)

The social comparative feedback of EnergyWiz did not provide much learning and self-enhancement benefits according to the interviewees. One reason for this is that EnergyWiz did not offer a communication channel between the comparing parties in the application through which users could exchange tips.

At the same time, in interviewees' opinion, competitiveness was addressed in an engaging way.

While the Neighbours and Ranking features attracted a small part of the competitive users, the Challenge feature was undisputedly their favourite. Friends seemed to be attractive comparison subjects for competitions and unknown similar users did not. Some individuals even stated that they would only enter a competition with peers.

Discussion

In order to interpret the above findings, we turned to social psychology applying the established Proxy Model, which evolved from Festinger's Theory of Social Comparison Process [19]. It provides information for anticipating an individual success at an unfamiliar task: if two individuals have performed in the past a similar task at their maximum effort and achieved similar results, then related attributes are disregarded in the prediction of their performance of the new task. Therefore, it is very likely that relevant attributes, such as household size and house type are disregarded when users have had a pre-existing relationship and share similar achievements in a comparable activity. This provides a possible explanation for the preference of competitive users to compare with friends. Designing with intent to show the similar performance of competing users in the past can therefore positively influence energy saving.

In addition, the Proxy Model states that relative attributes gain importance for the user's anticipation of success when the effort on the previous tasks is ambiguous or unknown [19]. This explains the overwhelming preference for similar comparison subjects by users motivated by benchmarking. Since energy saving is not wide-spread yet, users probably find it challenging to find friends who share common

past achievements. Therefore, they turn to comparing with similar others to evaluate their abilities. Due to the various factors which influence energy consumption, persuasive applications should at best provide benchmarking with similar friends to combine both similar past experience and relevant attributes. When this is impossible, the similarity of the comparison subjects should be effectively communicated.

Finally, our results suggest that learning is not well supported by social comparison which can be achieved by providing a direct communication channel between the participants. Self-enhancement motivations can be addressed through comparison with dissimilar comparison subjects (worse or better performing) [18].

Conclusion

In this paper, we have presented the initial findings on providing relevant comparison subjects depending on users' motivations for comparison. Our preliminary results showed that friends are suitable comparison subjects for competition while similar others better address motivation for benchmarking. Furthermore, direct communication channels can improve learning from comparative feedback and comparison with dissimilar others can address users who are motivated by the prospect of self-enhancement.

Due to the early research stage, our study group was homogenous and relatively small which might have influenced the research results. In the future, we plan to further investigate this topic and address the shortcomings using EnergyWiz in a long-term field study which is currently planned with 30 households. This study will feature automated consumption data provisioning through smart monitoring infrastructure.

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