

# Design for Energy Conservation Intervention: Lessons Learned from Weight Loss Intervention

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## Abstract

Self-monitoring behavioral interventions for weight loss and energy conservation share some common ground in terms of their intervention approach and feedback design and delivery. Through examining the similarities and differences of how weight and energy feedback are designed in behavioral interventions, this paper presents what we have learned from these similarities and differences. We then propose three design and methodological implications to present how weight loss intervention can inform us regarding how to better design energy conservation intervention.

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## 1 Introduction

An important design goal for both weight loss and energy conservation is to motivate people to change their habits and behaviors. Research has pointed out that self-monitoring is an effective approach to promote healthy and energy-saving behaviors (Dubberly et al., 2010; Pallak and Cummings, 1976; Turk et al., 2013). This paper takes the initiative to examine how weight and energy feedback are designed and delivered via self-monitoring behavioral interventions. Through looking into literatures from weight intervention research and sustainable human-computer interaction, this paper compares how feedback and behavior intervention are designed similarly and differently for weight loss and energy conservation. More specifically, the paper aims to answer the following three questions: (1) How are people's health and pro-environmental behaviors connected? (2) What are the similarities and differences between the feedback and intervention design of body weight and that of energy use?, and (3) What can we learn from these similarities and differences?

## 2 Connected Traits in People's Health and Pro-Environmental Behaviors

Several researchers have taken the initiative to examine the relationship between pro-environmental and health behaviors. Katalin (2008) has examined the common motivational roots between health and pro-environmental behaviors such as personality and values. She found that pro-environmental and health behaviors are positively correlated. Participants in the study who behave in an environmentally friendly way also lead more healthy lifestyles. Harrison (2014) also summarized a series of studies that examined the relationship between environmental concern, health, and fitness. For example, it has been found that those who purchase sustainable food were more likely to be physically active compared to non-consumers (Nie and Zepeda, 2011; Schifferstein and Oude Ophuis, 1998; Torjusen et al., 2010). These findings suggest there exists a potential opportunity to encourage people's healthy and pro-environmental behaviors simultaneously in one single behavior intervention. To achieve this, we look into how weight loss and energy conservation interventions are designed and conducted similarly and differently.

## 3 Similarities and Differences: Feedback and Intervention Design for Weight Loss and Energy Conservation

Similarities and differences of how weight feedback and energy feedback are designed and delivered through intervention studies are discussed below.

### 3.1 Similarities

#### 3.1.1 Feedback Design

Both descriptive and prescriptive feedback are commonly seen in weight loss and energy conservation interventions. Prescriptive feedback is more dominant in weight loss intervention (e.g., suggestions from professional agencies such as American Cancer Society). Descriptive feedback on the other hand is

more commonly seen in energy conservation intervention, such as displaying kWh and the amount of CO<sub>2</sub> emissions equivalent to energy use. Energy-saving tips are prescriptive in nature, but they are less commonly used due to the sustainability of message content, and the ease to neglect the contextual cues.

### 3.1.2 Feedback Delivery

Weight and energy feedback are delivered at various frequencies through different communication channels. Information delivered in real-time and daily has been shown to be most effective on behavioral outcomes (Delmas, 2013; Turk et al., 2013). Newsletters and paper diaries are paper-based medium frequently used in weight loss intervention while electricity bill is the most common paper artifact appeared in energy conservation intervention. Smart phones, text messaging, and email are all popular digital medium in weight loss and energy conservation interventions.

### 3.1.3 Communication Strategy

Goal-setting and social comparison are two frequently used communication strategies. These strategies can be applied at the same time, and research has indicated that a combination of multiple strategies used simultaneously yields stronger effects, compared to using a single strategy or technique (Abrahamse et al., 2005).

## 3.2 Differences

### 3.2.1 Different Levels of Involvement in Intervention

Weight loss interventions make use of multiple intervention components simultaneously, and demand more involvement from the user side (i.e., receive daily behavioral challenges, submit paper or electronic diary, attend face-to-face group sessions, communicate with therapists). Energy conservation interventions tend to be more design-oriented, focusing on people's reactions toward a specific design concept or technological solution, and demanding relatively less inputs from users (e.g. manual data entry, questionnaire answering).

### 3.2.2 Different Lengths of Feedback Display

Compared to energy consumption data, body weight is not an "always-on" feedback - the number disappears when people step off the scale. Kay et al. (2013) has proposed to change this view, making an "always-on" scale that continuously shows a current estimate of one's weight based on his past historical measurements. By the same token, the greatest advantage of the "always-on" residential electricity feedback (e.g., e-meter) lies in allowing people to learn and observe how the amount of energy they consume changes over time in everyday life.

### 3.2.3 Different Flexibilities of Data Presentation

Body weight is often displayed on a weighing scale, having less flexibility in terms of data presentation format and display choices comparing to energy consumption information. Aside from smart phones, WiFi-capable point source meters and wearable computing devices are widely adopted in energy conservation interventions while weight loss interventions stay primarily with email, SMS, PDA, and electronic scale (Burke et al., 2011).

## 4 Lessons Learned from Similarities and Differences

### 4.1 Design Implication: Display Weight & Energy Feedback Together on a Single Interface

Both weight and energy feedback can be delivered at the same frequency and through the same type of communication medium. They could prompt people to reflect on a series of personal choices and lifestyle. Moreover, displaying weight and energy feedback together on one single interface brings mutual benefits to both sides. In terms of the benefits for weight feedback, the smart technologies used broadly in energy conservation intervention bring flexibility and variety to track and present body weight values (e.g., dynamic visualizations, portable displays). In addition, the "always-on" energy feedback offers an alternative way to communicate the body weight values to people. In terms of the benefit for energy feedback, it offers people a channel to reflect on the co-benefits of health and environment (Higgins, 2005) more easily. In other words, certain behaviors such as exercise-based transportation and less consumption of meat are suggested to be better for both one's health and the environmental sustainability (Scarborough, 2014). Seeing one's weight and energy feedback together on a single interface could help facilitate these thought processes.

#### 4.2 Methodological Implication: Examine the Added-Value of Each Intervention Component

Insights from weight loss interventions have pointed out the need to address the confounding effects among multiple intervention components used simultaneously in a single intervention study (Abrahamse et al., 2005; Delmas et al., 2013). This notion will help us better determine which component(s) is more effective in stimulating energy-saving behaviors. In other words, we need to pay attention to different major determining factors of behavioral change rather than the behaviors alone, whether it is technology (e.g. smart tracking or sensing devices), use of specific behavioral prompts (e.g. manual daily log or diary), or the types of intervention techniques used (e.g. receiving prescriptive tips or consumption report via email).

#### 4.3 Methodological Implication: Value of the Daily Challenge Approach in Behavior Intervention

Using behavioral challenges that prompt specific kinds of actions is a commonly used intervention approach to improve one's health by engaging people in positive incremental changes daily (Fogg, 2003, 2011) - a more effective way to foster long-term behavior change compared to setting up big goals and resolutions. An app named Daily Challenge is an example of this that motivates people to complete tiny tasks daily for various aspects of well-being (e.g., fit in a walk by parking as far away as you can or getting off the bus or subway one stop early). Daily challenges delivered through a mobile app can be seen more often in health-related interventions (Chang et al., 2014; Terry et al., 2014) than interventions that aim to provoke eco-friendly behaviors (e.g., Con Edison Ways to Save). In most cases, apps that provide eco-friendly challenges and tips tend to be directly translated from various information resources such as websites and books (e.g., 125 Ways to Go Green, 100 Energy Saving Tips), serving more as a reference tool rather than a medium to engage people in pro-environmental behaviors.

### 5 Conclusion and Future Work

This paper proposes design and methodological implications for energy conservation intervention by examining how weight feedback and weight loss intervention are designed similarly and differently. The next step will be to validate these design and methodological implications through empirical studies. This would enhance our understanding toward improving the energy conservation intervention as well as the multiple behavior change intervention in HCI research.

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