

# Opportunities and Challenges in Mining Behavioral Economics to Design Persuasive Technology

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## ABSTRACT

Behavioral economics examines people's decision making processes in everyday situations. I argue that behavioral economics can provide a repertoire of a tool that can inform the design of persuasive technology. In this position paper, I propose strategies drawn from behavioral economics, and identify opportunities and challenges in applying the strategies to the design of persuasive technology. This position paper is a modification of the paper [16].

## Author Keywords

Persuasive technology, behavioral economics, decision making, decision bias, choices

## ACM Classification Keywords

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

## General Terms

Design

## INTRODUCTION

The role of information technology in people's daily decision making is steadily growing. For example, we decide which route and transportation to take to visit a friend's house, which restaurant to go for dinner, or which grocery products to buy based on the information and choices presented in information technology applications. This change offers tremendous opportunities for human-computer interaction (HCI) researchers to provide interventions to assist people to make self-beneficial or pro-social choices.

As one way to promote self-beneficial choices, we suggest approaches drawn from the field of behavioral economics. Behavioral economics examines the gamut of large and small decisions people make about such choices as how much to invest in retirement savings, whether to join a health club, and whether to eat a delicious but caloric candy

bar. The persuasive element in this approach consists of presenting choices in a way that leverages people's decision processes and induces them to make self-beneficial choices [17].

We argue that designs for HCI that leverage behavioral economics theory and research are a highly promising avenue for persuasive technologies. Although widely discussed outside the HCI and design communities in both academic and popular arenas (e.g., [24]), this approach has not yet influenced our field. The message of behavioral economics is simple: people are susceptible to decision bias, which often makes it hard for them to make self-beneficial choices. Thus, we should present choices in a way that helps people to make self-beneficial choices and understand the implications of their decisions as well—all without restricting their freedom of choice.

In this paper, I explain several behavioral economics theories and discuss opportunities and challenges in applying the theories to the design of persuasive technology.

## APPLYING BEHAVIORAL ECONOMICS

Departing from the premise of economics that people make rational choices, behavioral economists have shown that people's decision making processes are biased by various situational factors, such as the manner in which options are presented and the times when the choices are offered, and the emotional or visceral state of the person at the time of choice [1, 12]. This understanding of people's decision biases provides a rich repertoire of tools that designers can leverage. In this section, we present five decision biases and discuss how these biases can be leveraged in the design of persuasive technology.

### Default Bias

When people make choices, they tend to favor the default option or the status quo, rather than taking the time to consider and then adopt an alternative state [11, 21]. People tend to take "the path of least resistance," and keep doing what they have been doing, or doing what comes automatically, even when they can make improvements. The reasons for this decision bias could have roots in people's limited attention and tendency to "satisfice" [21], their perception that an organization's selection of a default

option constitutes a recommendation (see [6]), and the implied popularity of the default option.

Default biases have been blamed for a wide range of undesirable outcomes, including Americans' excessive consumption of fries and large sodas as part of "supersized" meals at McDonald's [17]. Yet if carefully designed, the default bias can be a powerful tool to propel people toward self-beneficial behaviors (see [5, 23]).

#### *Opportunities*

**Convenience and salience.** HCI design can leverage the default bias in many ways, by making healthy choices more convenient and salient physically and cognitively. In the domain of snacking, featured healthy snacks can be made easy to access, e.g., on websites, on vending carts, and so forth. For example, on a website, the checkbox of healthy snacks among available options could be selected as the default, reducing the need to select one of these options explicitly. Or when presenting sale items at a bakery, a system could filter and first offer items that are made with whole grain flours. For a kiosk system, the placement of buttons, the number of clicks or the number of screens a user has to access to choose an item could be decreased or increased to change the perceived priority of a snack or sandwich order.

An eldercare robot working in a nursing home could organize the physical placement of food in a way that the healthy food is placed closer to an elder's room. In addition, a snack delivery robot might only deliver healthy snacks to people's offices, but require people to walk to the robot to get unhealthy snacks.

Convenience can be further leveraged using sensing technologies that tell people when they are near healthy snacks. For instance, if shoppers are in a food court in a mall, the system could present healthy choices to them via mobile phone as convenient food options.

Default bias is different with other biases presented in the paper; leveraging default bias can be effective, even with those who are not motivated to change their potentially problematic behaviors, or are not aware of issues with their current behaviors [16].

**Attention span.** People might be more subject to default bias when their attention spans are limited or when they do not have enough time to do exhaustive search. HCI technology can target moments when people's attention spans are limited, such as when they are using mobile devices on the move, or when people are making decisions with limited time, such as when they are ordering food in a fast-food restaurant, or making choices in a public kiosk.

Interface components can be also designed to manipulate people's attention spans. The use of banners or graphic images may be distracting [1], reducing people's attentiveness and efforts in making decision.

#### *Challenges*

Depending on the way it is implemented, the default strategy may harm people's experience of making a choice [16]. Explicitly suggesting a certain options as default may cause people to feel forced to make those choices. Careful design of the strategy and iterative testing of its efficacy and its impact on people's experiences will be important.

Another caveat in using default strategy might be its lack of educational effect. In comparison to persuasive techniques that use informative messages (e.g., indicating consequences of choices), the default strategy do not provide any information that people can use to reflect on their behaviors and learn the consequences of their choices. If users are subsequently put in a new environment without the interventions, the changed behaviors may not continue. Designers using the default strategy should be aware of this potential problem, and consider using them with educational methods. New research is needed to understand the long-term effects of these techniques.

#### **Present-biased preference**

Present-biased preferences represent people's tendency to weigh the pros and cons of present choices more heavily than future choices, and to underestimate their needs in the future. This decision bias is also known as "time discounting" [18]. The tendency typically promotes unhealthy eating because the immediate pull of tasty food is likely to eclipse considerations of future health consequences. However, present-biased preferences can be used to encourage healthier choices if people are asked to plan ahead. Read and van Leeuwen [19] gave their participants a choice of snack to be eaten in one week or at the time of eating, the next week. They found that their participants chose far more unhealthy snacks for immediate choice than for advance choice.

#### *Opportunities*

**Strategic design of timing of choice.** Present-biased preferences can be leveraged by strategically designing the time that technology applications prompt users to make certain choices. Researchers in context-aware technology have been designing applications that can sense the current activity of people and learn their routines over time [4]. A meal planning application or a restaurant reservation system that nudges people to make a choice when they are less likely to be hungry (i.e., 1-2 hours after their lunch) might be as effective as the application that uses persuasive messages or calorie information, and it might be felt to be less intrusive.

#### *Challenges*

The success of the planning strategy may depend on people's satisfaction with the choice made previously at the time of consumption. Even when people spontaneously made choices that would have long-term benefits and delayed gratification (e.g., granola bars over more delicious chocolate bar), they may not like their choices anymore at

the moment when they experience the outcomes of their choices. If this experience continues, people may stop using the technology or change their minds at the time of consumption. Systems would need to help people stick with their choices and influence them to stay happy with their choices. Messages that remind people of the positive aspects of their choices may mitigate potential negative feelings.

### **Diversification heuristic**

Diversification heuristic or naïve diversification means people's tendency to seek variety when making several choices at once [20, 22]. This bias applies to a lesser degree when people make the same type of choices sequentially over time. For example, when people are asked to pick four snacks for one month at once, they tend to choose four different snacks; on the other hand, when people are asked to pick a snack each week, they tend to choose their favorite snack, having the same four snacks for one month.

### *Opportunities*

Diversification heuristic can be leveraged by prompting people to make another choices for the future when they make short-sighted choices. For example, when people order an unhealthy snack to eat immediately, the system can prompt them to make a choice for their next snack. Both diversification heuristic and present-biased preference suggest that people are more likely to choose healthy snacks as their next snack. On the other hand, when people make healthy choices for immediate consumption, the system may not prompt them for future choices, so that they do not choose unhealthy choices for the sake of diversity.

### *Challenges*

Providing incentives for people to make choices for future (e.g., a discount) will be important to encourage people to take another step to make a future choice.

### **Licensing effect**

Licensing effect refers to people's tendency to indulge themselves (i.e., making vice choices) after they make choices that activate a positive self-concept (i.e., making virtue choices) [13]. For example, people may feel that they deserve a high-caloric dessert after having a healthy salad for lunch. Some research suggests that prior choices can influence subsequent choices even in different domains. For instance, after donating their money to a charity, people may feel licensed to buy a luxurious item for themselves.

### *Opportunities*

Persuasive technology can adaptively change its information presentation to help people avoid licensing effect biases. In a system that tracks people's previous choices, when they have made virtuous choices (e.g., exercising instead of watching TV on a couch, or carpooling instead of driving), the system may not show or

emphasize the tracked behaviors in order not to encourage any licensing behaviors.

### *Challenges*

There is little consensus on how people make decisions in responses to their prior choices. Transtheoretical model suggests that the system needs to applaud people making progresses in changing their behaviors in relation to their goals [8]. Licensing effects suggest that emphasizing their previous good behaviors can induce people to feel deserved to deviate from the good behaviors. More research is needed to better understand what factors cause the differences in their subsequent choices [10].

### **Asymmetrically dominated choices**

People tend to make choices that are easier to judge as superior than other alternatives. One example of this tendency is the "asymmetric dominated choice" [9], which means placing a choice option next to an inferior option to increase its attractiveness.

### *Opportunities*

Asymmetrically dominated choices can be leveraged by intentionally including an inferior option when presenting many options. For instance, consider a cookie as compared to a large, shiny Fuji apple and a small withered apple. By pairing the Fuji with the withered apple, the Fuji's value seems much higher, and choices of the Fuji will increase.

### *Challenges*

Paring only a few options with obviously inferior ones can make users feel suspicious about the systems. In addition, in many choices, finding a clearly inferior option is difficult, which makes this approach practical only to a certain type of choices.

## **NEEDS FOR SYSTEMATIC DESIGN AND EVALUATION**

In the previous sections, I described several decision biases drawn from behavioral economics, and opportunities and challenges in leveraging them in the design of persuasive technology. Theory-based design should be implemented through iterative design processes and evaluated systematically to test its efficacy as documented in [16]. Previous research has showed that some design features do not work in the real world, even when theory predicted their effect [1, 16]. In the real world, there might be other factors that may eclipse the power of the intervention strategy. Characteristics of different design media (website, mobile phone, and/or robot) can influence how theory would work.

## **CONCLUSION**

Behavioral economics research suggests that extremely simple changes in user interfaces can have a substantial impact on people's choices. In this workshop, I hope to have a lively discussion on strengths and weaknesses of design strategies drawn from behavioral economics, and

identify domains and situations where these approaches would be most appropriate and useful.

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