Computers in Human Behavior 77 (2017) 249–257

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full length article

Effects of gain-versus loss-framed performance feedback on the use of fitness apps: Mediating role of exercise self-efficacy and outcome expectations of exercise

Joon Soo Lim [a], Ghee-Young Noh [b, *]

[a] Department of Public Relations, S.I. Newhouse School of Public Communications, Syracuse University, 215 University Place, Syracuse, NY 13244, USA
[b] Healthcare Media Research Institute, School of Media Communication, Hallym University, 1 Hallymdaehak-gil, Chuncheon, Gangwon-do, 24252, South Korea

ARTICLE INFO

Article history:
Received 4 April 2017
Received in revised form
30 July 2017
Accepted 5 September 2017
Available online 5 September 2017

Keywords:
Fitness app
Persuasive technology
Mobile health technology
Gain frame
Self-efficacy
Persuasion

ABSTRACT

Grounded in prospect theory and self-efficacy theory, this study examines the effect of message framing on users' intentions to adopt fitness applications ("apps"). Through the use of a laboratory experiment employing a specially designed fitness app, we tested the effectiveness of gain-framed performance feedback in the adoption of the fitness app as well as in enhancing exercise self-efficacy and outcome expectations of exercise. Results of this study show the advantage of gain-framed messages over loss-framed messages in increasing user's intentions to use the app. A mediation analysis using a bootstrap method revealed that the effect of the gain-framed messages on users' intentions to use the fitness app was mediated through exercise self-efficacy and outcome expectations of exercise.

1. Introduction

Health psychologists have long examined the effects of health messages on individuals' behavioral choices (Rothman & Salovey, 1997). In the 20th century, such messages were conveyed through interpersonal communications or mass media. With the advent of ubiquitous mobile technologies, both health service providers and researchers have found that mobile technologies such as smartphone applications (apps) can offer a new method of conveying an intervention message to motivate users to adopt health-conscious choices (Choe, Lee, Munson, Pratt, & Kientz, 2013; Fanning, Mullen, & McAuley, 2012). Indeed, several fitness apps that incorporate various persuasive features have been rolled out to the market in order to engage users in regular exercises (Higgins, 2016). With this ease of use and mobility, these fitness apps allow people to feel enhanced exercise self-efficacy of physical exercises.

The fundamental challenge for the developers of e-health technology is how to make people try out the fitness app and adhere to the app once they start using it. In order to increase the successful usage of the app, persuasive technology researchers (Choe et al., 2013; Hermsen, Frost, Renes, & Kerkhof, 2016; Khalil & Abdallah, 2013; Park & Noh, 2015; Thomson, Nash, & Maeder, 2016; Yoganathan & Kajanan, 2013) have emphasized the importance of the presentation of the apps' persuasive features. One such persuasive feature is real-time performance feedback that enables users to self-monitor their progress while performing physical exercise (Choe et al., 2013; Hermsen et al., 2016). This performance feedback message has been successfully used in the popular game *Wii Fit* to enhance users' exercise self-efficacy and adherence to *Wii Fit* (Chao, Scherer, Wu, Lucke, & Montgomery, 2013).

Grounded in self-efficacy theory (Bandura, 1977) and prospect theory (Kahneman & Tversky, 1979), our assumption was that the shift in the frame of performance feedback in the fitness app could influence the rate of adoption of mobile apps for fitness purposes. Prospect theory (Kahneman & Tversky, 1979) suggests that people tend to make a decision (e.g., keep on using a fitness app) after assessing the perceived benefit or risks associated with a message and that the framed appeals in the message could play an important role in individuals' likelihood to adopt the advocated behavior (Rothman & Salovey, 1997). In particular, we note that health

* Corresponding author.
E-mail addresses: jlim01@syr.edu (J.S. Lim), gnoh@hallym.ac.kr (G.-Y. Noh).

http://dx.doi.org/10.1016/j.chb.2017.09.006
0747-5632/

psychologists have stressed the relative effects of gain-framed appeals and loss-framed appeals for different health-promoting behaviors (Donovan & Jalleh, 1999; Rothman, Salovey, Antone, Keough, & Martin, 1993). A meta-analysis of the framing effect has demonstrated a relative advantage of gain-framed appeals over loss-framed appeals in achieving preventive health behaviors (Gallagher & Updegraff, 2012).

The current study aims to test the effects of the performance feedback in a fitness app on achieving individuals' use of the fitness app. Based on findings from previous research, we assumed that gain-framed messages in the performance feedback would have a greater effect on the adoption of the fitness app than loss-framed messages on the grounds that the physical exercise is considered to be a preventive behavior (Choe et al., 2013). Using a laboratory experiment, we tested the effectiveness of the framing strategy of performance feedback in encouraging health-related behavioral choices (i.e., the adoption of the fitness app). We also tested the effectiveness of the framing strategy in terms of enhancing exercise self-efficacy and outcome expectations of exercise.

2. Theoretical background

2.1. Framing in persuasive technology: insights from prospect theory

Smartphone fitness apps provide users with several features that help achieve intended health goals—such as monitoring eating habits and exercise adherence (Higgins, 2016). To encourage individuals to keep using the app, developers need to be familiar with the persuasive effects of each feature on behavioral change and adherence. Along with default features (e.g., goal-setting, recording exercise data), developers have learned that interactive features, like individually tailored feedback, lead to the increased effectiveness of the fitness app (Higgins, 2016). For instance, Glynn et al. (2014) conducted an 8-week field experiment to measure the effectiveness of a fitness app in achieving physical activity goals among 90 patients referred to them by their primary care physicians. The intervention group was given a fitness app and a detailed instruction message; the control group was not. They found a significant main effect of the use of the fitness app on physical activity, demonstrating greater mean improvement in the intervention group's daily step count than the control groups.

While these studies (Glynn et al., 2014; Higgins, 2016) revealed the effectiveness of the fitness app in helping users to achieve physical goals, the studies results also showed the comparative advantages of the fitness app in achieving enhanced physical activity over controlled groups that were not given the app. From a persuasive technology design perspective (Thomson et al., 2016), an emerging question is how the fitness app can make people choose the app and use it repeatedly in exercise. Bandura (1997) explains that the success of an intervention effort in promoting preventive action depends on the persuasive communication strategy. Out of the available persuasive communication strategies, prospect theory has provided particularly useful theoretical insights. According to prospect theory (Kahneman & Tversky, 1979), individuals' behavioral choices can be greatly affected by a change of reference point in assigning the value of the product's attributes to either gains and losses. Adopting a new habit (e.g., 10,000 steps a day) as well as switching to a new solution (e.g., using a fitness app) to promote a healthier lifestyle requires individuals to consider the potential benefits and risks associated with the newer solution in comparison to the benefits that people have in keeping their current solution, or, a reference point. In terms of the major premise of prospect theory, gain-framed messages stress the positive outcomes appeals to the risk-averse mind by activating the attitude of 'play it safe,' whereas loss-framed messages, which presents the negative outcomes, appeals to the attitude of 'nothing to lose' for performing the unwanted outcomes (e.g., breast cancer) (Dijkstra, Rothman, & Pietersma, 2011, p. 1038).

Several studies have examined how a shift in the frame of a health message in terms of gain versus loss frames could alter individuals' preferences and decisions in relation to various health behaviors, such as fruit and vegetable intake (Dijkstra et al., 2011; Godinho, Alvarez, & Lima, 2016), adherence to physical activity (Brawley, Culos-Reed, Angove, & Hoffman-Goetz, 2003; Latimer, Brawley, & Bassett, 2010), intentions to exercise (Arora, Stoner, & Arora, 2006), intentions to perform breast self-examination (Meyerowitz & Chaiken, 1987) and intentions to get a HIV/AIDS test (Hull & Hong, 2016). In the context of the fitness activities and exercise, a positively framed message (e.g., Exercising regularly can help you lose weight) promotes potential benefits of performing an advocated action, whereas a negatively framed message stresses the adverse consequences of not performing the advocated action (e.g., If you don't exercise, you may gain weight) (Arora et al., 2006). The gain-framed message tends to make individuals feel risk averse in their choices and engage in performing the advocated behaviors (Rothman et al., 1993). Results of the framing effect of persuasive messages yielded mixed results, with some studies showing the superiority of positive frames (Rothman et al., 1993), whereas others show that negative frames yield a greater effect (Donovan & Jalleh, 1999). Some studies found the exposure to gain-framed messages increased desired health behaviors, while others found that loss-framed messages had a greater impact than the gain-framed messages (Meyerowitz & Chaiken, 1987). Rothman, Martino, Bedell, Detweiler, and Salovey (1999) summarized that "loss-framed messages are more effective when promoting illness-detecting (screening) behaviors, but gain-framed messages are more effective when promoting health affirming (prevention) behaviors" (p. 1355). In other words, the effectiveness of framing of the health message is dependent on the type of the promoted health behavior in terms of detection or prevention (Rothman et al., 1999).

Gallagher and Updegraff's (2012) meta-analytic review of the framing effect on health behaviors indicated that the gain frames had an advantage over the loss frames in making people engage in preventive health behaviors (e.g., physical activity). Based on the findings, they concluded, "how you frame a health message is an important consideration in the design of messages promoting prevention behavior" (Gallagher & Updegraff, 2012, p. 113).

Based on the aforementioned research, we assumed that individuals are more inclined to engage in a preventive behavior when the potential benefits are explained to them (Rothman et al., 1993). The adoption of the fitness app is a sort of intervention to promote healthy behavior, and thus, the gain-framed appeal should be more effective than the loss-framed appeal in making people adopt the fitness app for maintaining their health. Choe et al. (2013) also suggested that the use of a gain-framed message in fitness apps would have a more positive impact on a healthy behavioral choice than a loss-framed message, because engaging in physical exercise promotes preventive behaviors. In addition, previous research (Rothman et al., 1993) suggest that the level of involvement of individuals with particular health-related options moderates the effects of gain-versus loss-framed appeals on individuals' behavioral choice. Therefore, we posit the following hypothesis:

H1. The gain-framed appeal will have a greater effect on the use of the fitness app than the loss-framed appeal, after controlling for participants' involvement in exercise.