

Anti-smoking educational game using avatars as visualized possible selves

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Using Avatars as Visualized Possible Selves

Abstract

Few social smokers envision themselves being affected by the negative consequences of smoking despite well-known facts that smoking causes serious illnesses and death. However, as smoking habits quickly develop, social smokers cannot be free from the negative consequences of smoking. In this study, we pose the following question: “Would showing social smokers’ possible future as a consequence of smoking help them alter their current smoking behaviors?” Thus, using the theoretical concept of *possible selves*, an anti-smoking educational game was created in which players could see changes to the appearance of their future selves as a consequence of smoking. We used a 2 (Future face: Showing vs. Not showing) x 2 (Self avatar: Self-avatar vs. Other-avatar) between-subjects design for the experiment. Results indicated that participants who viewed the future face, compared to who did not, reported more negative attitudes toward social smoking and greater intention to quit smoking. The main effect of the self avatar was insignificant; however, seeing the future face in the self-avatar condition led to an increase in perceived risks compared to other-avatar condition. The implications of using avatars as visualized possible selves in health promotion are discussed.

Keywords: educational game, serious game, smoking, possible selves, susceptibility

Anti-Smoking Educational Game Using Avatars as Visualized Possible Selves

1. Introduction

1.1. Social smokers

Cigarette smoking is still the leading preventable cause of serious health problems in the U.S. Each year, roughly 443,000 premature deaths are caused by smoking (CDC, 2010). For every person who dies from a smoking-related disease, 20 more people suffer from at least one serious illness due to tobacco use (CDC, 2010). Despite these grim statistics, one in five U.S. adults (46.6 million) report being current smokers. Moreover, young adults continue to engage in the highest rates of smoking, according to the 2008 National Survey on Drug Use and Health (Substance Abuse and Mental Health Services Administration, 2009). Twenty two percent of young adults are smokers and about 2,200 adults ages 18 and above are becoming daily smokers everyday (CDC, 2010).

Smoking among young adults is often characterized by social smoking. Social smoking is common among college students; more than half report smoking occasionally in social settings such as bars and parties (Choi, Choi, & Rifon, 2010). Social smokers usually do not carry a pack of cigarettes, but smoke when initiated by others (Berg et al., 2009; Levinson et al., 2007). Most social smokers regard social smoking as almost innocuous by downplaying risks. Roughly half of social smokers do not identify themselves as smokers, although they do accept that they smoke (Berg et al., 2009; Levinson et al., 2007; Song, Kim, & May, 2011). Due to the discrepancy between the behavior and self-identification of social smokers, some researchers call this group “phantom smokers” (Choi et al., 2010). Furthermore, social smokers’ willingness to quit smoking tends to be lower than regular smokers (Moran, Wechsler, & Rigotti, 2004). As

such, few social smokers envision themselves being affected by the negative consequences of smoking despite well-known facts that smoking causes serious illnesses and death.

However, as smoking habits quickly develop, social smokers cannot be free from the negative consequences of smoking. More than one-third of college smokers report increased rates of smoking during college (Harris, Schwarz, & Thompson, 2008), and one in every five social smokers becomes a daily smoker during four years at college (Kenford, Wetter, Welsch, Smoth, Fiore, & Baker, 2005). Given the fact that the majority of social smokers do not identify themselves as smokers and thereby do not perceive themselves to be susceptible to the consequences of smoking, we pose the following question: “Would showing social smokers’ possible future as a consequence of smoking help them alter their current smoking behaviors?”

The current study describes the impact of an educational game that uses new technology to simulate the negative consequences of smoking by presenting players with images depicting their future. In the game, individuals can see and play *as* the virtually embodied future self (i.e., an avatar) to experience the impact of smoking now on their appearance in the years to come. Thus, we examine whether seeing and controlling a vivid visual representation of the future self would increase social smokers’ perceived risks and change smoking behaviors while increasing receptivity to anti-smoking messages.

1.2. Avatars as Visualized Possible Selves

Although individuals are aware of the detrimental effects of smoking, the immediate and satisfying feelings that smoking brings often outweigh consideration of future consequences. Trope and Liberman (2003) propose that individuals may make less accurate decisions and predictions about their future because they inherently have lack of information about the future. However, they suggest that current behaviors will change for the sake of the benefits in the

future when “salient and concrete” information about the future is given and when the benefits or costs of future seem important enough to sacrifice the present pleasure or need (Trope & Liberman, 2003). In a similar vein, Zimbardo and colleagues (Zimbardo & Boyd, 1997; Zimbardo et al., 1997) conceptualized the *temporal perspective*, which posits that the abstract cognitive processes of constructing the future can influence current decision making in ways that help individuals avoid current sources of gratification that may cause negative consequences in the future (D’Alessio, Guarino, De Pascalis, & Zimbardo, 2003). In fact, studies have found that individuals with an ability to envision the future in the long term (*future time-oriented*) are less likely to engage in substance use (D’Alessio et al., 2003) and future time-oriented individuals are less likely to be exposed to HIV (Rothspan & Stephen, 1996).

In the current study, we created a digital game to help smokers envision their future by employing the theoretical notion of *possible selves*. Possible selves (Markus & Nurius, 1986) concern how individuals think of themselves, their potential, and their future. Possible selves can include feared selves and/or desired selves that reflect some aspects of a person’s current capabilities, attributes, and potential for change over time. Thus, possible selves can be understood as “cognitive bridges between the present and the future, specifying how individuals may change from how they are now to what they will become” (Markus & Nurius, 1986, p. 961). Possible selves play an important role in providing evaluative and interpretive contexts for the current view of self and motivation to change features of the self for the future.

We believe that the use of avatars, digital representation of the self in the game, can be an effective strategy to give shape to possible selves (see Commello, 2009 for related arguments). That is, with the help of new graphic technologies, possible selves do not need to be limited to abstract forms in the imagination; rather, possible selves can be visualized and embodied

realistically through avatars. Playing as an avatar in a virtual environment can enable individuals to glimpse future versions of themselves, along with the consequences of their current behavior, through visual representation. In other words, an avatar can act as a *visualized possible self*.

Although the term “possible selves,” has not been specifically employed by researchers in the field of educational games, several studies have examined the effects of avatars as digital representations of possible selves on individuals’ behaviors in virtual environments. For example, Fox and Bailenson (2009) examined how individuals respond when they observe their possible selves in the form of avatars. Participants were instructed to perform physical exercise in a virtual environment and were placed into one of the three conditions: (a) seeing their desired possible selves (e.g., avatar losing weight), (b) seeing their feared possible selves (e.g., avatar gaining weight), and (c) no possible selves (no avatar). Results revealed that seeing possible selves, both desired and feared possible selves, was more effective in changing exercise behaviors than not seeing possible selves. Along the same line, Hershfield and colleagues (in press) investigated the effect of possible selves by utilizing photos depicting individuals’ digitally aged faces in virtual environments. Results showed that individuals who viewed their aging possible self, particularly their feared future self, allocated more money toward a retirement account than people who viewed their current self. These studies altogether indicate that the use of possible selves in a virtual context can be an effective means for changing people’s behaviors.

Acknowledging the importance and effectiveness of possible selves, the current study utilizes an avatar as a *visualized possible self* to represent how an individual might look in the future as the consequence of smoking. We propose to test if seeing the future face that is

realistically and concretely visualized will increase risk perception and the negative attitude toward social smoking resulting in intending to quit smoking. Additionally, we explore whether seeing the future face embedded in the avatar will influence the identification with the avatar.

H1a-c: Participants who play with an avatar showing current and future face subsequently will demonstrate (a) higher perceived risks (b) more negative attitudes toward social smoking, and (c) greater intention to quit smoking than those who play with an avatar showing current face only.

RQ1: How does seeing the future face affect identification with the avatar?

1.3. Tailoring and Perceived Susceptibility

The Health Belief Model (HMB) proposes that perceived susceptibility to risk impacts individual assessments of whether a certain health behavior should be adopted (Becker, 1974; Janz & Becker, 1984; Rosenstock, 1991). Increased perception of susceptibility to risk is key to a successful intervention. One way message designers can increase perceived susceptibility is by tailoring messages. Research suggests that personalized messages can be more effective for changing behaviors (Bandura, 1997; Pilling & Brannon, 2007) as individuals tend to pay more attention to tailored messages, are more prone to remember them, and consider the messages to be more trustworthy, compared to non-tailored messages (Rimal & Adkins, 2003).

The current study attempts to provide tailored messages graphically by depicting the physical appearance of the game characters (i.e. avatars) as similar or identical to the physical appearance of players. For example, studies in the field of similarity attraction have examined the effects of facial similarity (Bailenson, Iyengar, Yee, & Collins, 2008; DeBruine, 2004; Penton-Voak, Perrett, & Peirec, 1999). Penton-Voak and colleagues (1999) demonstrated that

moderate levels of similarity are linked to high perceived attractiveness and suggested that individuals generally do not react positively toward others who look very different physically. Even in the case of attraction toward infants, facial resemblance prompted the individual to express liking for the child. DeBruine (2004) presented color photographs of 3.5- to 6-month-old infants with a 50% morph of the participant's face as well as four other unfamiliar individuals' faces, and found that both men and women rated the photographs morphed with their own images to be the most attractive. In a study utilizing digitally morphed images of voters and American political candidates, Bailenson, Garland, Iyengar, and Yee (2006) found that in circumstances where the voters had little information about the candidates, simulated facial similarity positively influenced the voters' support for such candidates. A later study (Bailenson, et al., 2008) on the same topic further confirmed Bailenson et al.'s (2006) findings, concluding that facial similarity among voters and candidates had the strongest positive effect on electoral support when the voter is unfamiliar with the candidate.

Thus, it is possible that people may report a higher level of identification with the avatar as well as increased rates of message acceptance and perceived susceptibility to the consequences of smoking when they use a game character that depicts their own image. As such, the following hypotheses are proposed:

H2: Participants who play the game with an avatar that depicts their own face will report higher levels of identification with the avatar than those who play with an avatar that depicts someone else's face.

H3a-c: Participants who play the game with an avatar that depicts their own face will demonstrate (a) higher perceived risks (b) more negative attitudes toward social smoking, and

(c) greater intention to quit smoking than those who played with an avatar that depicts someone else's face.

H4: Participants who play the game with an avatar that depicts their own face will show higher levels of perceived susceptibility to the consequences of smoking than those who play with an avatar that depicts someone else's face.

2. Methods

2.1. Overview

The experiment was a 2 (Future face: Showing vs. Not showing) x 2 (Self avatar: Self-avatar vs. Other-avatar) between-subjects design. The *showing-the-future-face* condition (*future condition*) referred to a game setting in which the avatar's face became older (through digital modification) during the game play (i.e., showing both current and future face); whereas the *not- showing-the-future-face* condition (no-future condition) referred to a game setting in which the avatar's face remains in the young face (i.e., showing only current face). Changes to facial appearance were informed by the CDC's report that smokers get wrinkles much earlier and look much older than nonsmokers (CDC, 2002). The *self-avatar* condition indicated a game setting in which participants played with an avatar that depicted their own face; whereas the *other-avatar* condition indicated a game setting in which participants played with an avatar that contained someone else's face. In the other-avatar condition, we selected two faces, one male and one female, that participants had never seen before.

2.2. Participants

Participants were recruited from a large public Midwestern university in the U.S. Prior to the main experiment, an online screening test that explored participants' smoking-related perceptions and habits was conducted to obtain a qualified sample. A total of 414 individuals

participated in the screening test. Based on the results, 154 participants who reported smoking in the past 30 days were identified and contacted by researchers. Sixty two individuals responded and agreed to participate in the main experiment. Thus, the final sample consists of 62 smokers.

The average age was 22.05 years ($SD = 3.28$) with males ($n = 38$: 61.3%) outnumbering females ($n = 24$: 38.7%). Median of frequency of smoking was once a week. All participants ($N = 62$) had played video games before. Participants were randomly assigned into one of the four conditions: self-avatar in the future condition ($n = 15$), self-avatar in the no-future condition ($n = 15$), other-avatar in the future condition ($n = 16$), and other-avatar in the no-future condition ($n = 16$), with gender balanced across conditions.

2.3. Procedure

2.3.1. Game development

For the purpose of the current investigation, a computer game, “Super Smoky” was created (see Figure 1). Super Smoky is a Flash-based serious game that educates players about the risk of social smoking. Game designs were completed in Adobe Illustrator CS5 and imported into Flash CS5 as resources for game development. The game featured a character-creation function, which allowed researchers to upload participants’ photographs (headshot photos) so that each participant could play the game with a self-modeled character (i.e., self-avatar). Using a photo-aging technique called “Aging Booth,” the participants’ photographs were uniformly converted into digitally aged and wrinkled faces for the future condition of the experiment.

The game was designed to target college-age social smokers by incorporating facts about social smokers such as smoking contexts, reasons for smoking, and other smoking-related

attitudes. The game consisted of two levels with each level showing a common smoking context for social smokers (e.g., Level 1: Being stressed at school; Level 2: Hanging out with friends at bar) (Levinson et al, 2007). At the beginning of each level, brief instruction of game play and narrative were provided. In this single -player game, players could utilize controls for jumping and running to avoid other smokers and cigarettes. In order to complete each level, players needed to successfully go to school or stay in the bar by avoiding friends who suggest smoking or cigarettes. The “health bar” located in the bottom of the screen reflected how many times the player failed to avoid other smokers and cigarettes. At the end of each level, all the players, regardless of the participants’ performance, were given five quiz questions (total of 10 quiz questions) about the myths and dangers associated with social smoking. Quiz questions were based on anti-smoking campaign brochures available at the health center on the college campus. The example questions included “At what age do smokers have approximately as many wrinkles as non-smokers in their 40s?” “What percentage of social smokers among college students will still be smoking when they are seniors?” and “True or False: Smoking hurts my chances of getting a date.” After each question was answered, correct answers were provided along with explanations to give more detailed information about smoking. For example, following a sentence “True or False: Smoking doesn’t affect my school or work”, participants were asked to pick either True or False. Then, the following feedback was given: “The answer is False. Smoking will affect every part of your life. The average smoker is sick more than twice as much as a nonsmoker. Being a smoker makes you more likely to catch a cold than people who don’t smoke and the smoker’s symptoms will be worse, last longer, and are more likely to lead to bronchitis or pneumonia. This may result in a loss of pay or a lower grade in school.”

Participants in the no-future condition played with the same avatar in Levels 1 and 2. Participants in the future condition, on the other hand, were shown an avatar depicting their aged, future appearance upon completion of Level 1, and told that, since they could not avoid cigarettes effectively in Level 1, they had to play with this new avatar in Level 2. In both conditions, the game ended with a monograph from the game character that indicated regret about the decision to not quit smoking and suggested tips to quit smoking.

The game was fairly easy to play and designed in a way that anyone could complete each level. In fact, every participant successfully completed each level. Both levels in both conditions, however, had areas where participants could not avoid score reduction. In this, we could successfully regulate the game performance so that viewing the aged face in the second round would be acceptable to players. Players were expected to learn about social smoking and its risk through the avatar's monograph, the avatar's unsuccessful experience with getting a date because of cigarette smoking, and the information from the quiz.

2.3.2. Experiment process.

Prior to the main experiment, half of the participants were invited to have their headshot photos taken. The photo taken looked similar to passport photos. Researchers incorporated each participant's photo into the video game for the self-avatar condition. Approximately ten days after the photos were taken, all 62 participants were invited to a lab. Once participants arrived in the lab, researchers provided a brief introduction on how to play the game. Participants, who had their photos taken, were assigned to a self-avatar condition; whereas participants who had not had their photos taken were assigned to the other-avatar condition. To avoid any potential avatar effects in the other-avatar condition, two avatars were pre-set before the experiment: one male and one female avatar, whose gender was matched with that of the

participants. As to the future and no-future conditions, participants were randomly assigned to either of the conditions. Once the game play was done, which took approximately 10-15 minutes, participants were asked to complete post-test questionnaires. Participation was voluntary, and all of the participants received extra course credit for completing the study.

2.4. Measures

The screening test on smoking perceptions and habits included smoking identity (“Are you a smoker”: yes/no), social smoker identity (“Are you a social smoker”: yes/no), and smoking experience (“Have you smoked in the last 30 days?”: yes/no) following the work of Levinson et al. (2007).

A series of items were asked in the post-tests. *Perceived risk* ($\alpha = .93$; modified from Halpern-Felsher et al., 2004) was measured by nine sentences (e.g., “I feel that I will get bad cough from smoking”). *Attitude toward social smoking* ($\alpha = .83$) was measured by six sentences (e.g., “I don’t see any problem with social smoking habits”). *Intention to quit smoking* ($\alpha = .89$) was measured by six sentences (e.g., “When offered a cigarette, I will decline” and “I am going to cut down the number of cigarette”). *Identification* ($\alpha = .94$) was measured by three sentences (“I feel so close to my avatar,” “I feel connected to my avatar,” “I feel my avatar reflects me”). *Perceived susceptibility* ($\alpha = .78$) was measured by four sentences (e.g., “I think I may look like the old avatar in the future if I keep smoking”). Furthermore, perceived susceptibility was only measured among participants in the future condition. All of the responses were obtained on a 10-point Likert-type scale (e.g., 1 = “strongly disagree”, 10 = “strongly agree”).

3. Results

MANOVA and follow-up univariate F tests were conducted to test hypotheses and a research question. Results indicated significant differences across samples between the future and no-future conditions, Wilks' Lamda = .77, $F(4, 55) = 4.21$, $p < .01$, $\eta_p^2 = .23$. However, no significant differences were found between the self-avatar and other-avatar conditions, Wilks' Lamda = .94, $F(4, 55) = 0.90$, $p > .05$, $\eta_p^2 = .06$.

With regard to the effects of future face, H1a-c and RQ1 explored the effects of showing the future face (Future face: Showing vs. Not showing) on perceived risks (H1a), negative attitudes toward social smoking (H1b), intention to quit smoking (H1c), and identification with the avatar (RQ1). Univariate F tests indicated the significant main effect of future face on most of the dependent variables except perceived risk. For H1a, there was no significant difference on perceived risks, $F(1, 58) = 1.72$, $p > .05$, $\eta_p^2 = .03$, between the future condition ($M = 7.55$, $SD = 1.93$) and no-future condition ($M = 6.92$, $SD = 2.00$) (see Figure 2). However, interesting differences were found among participants in the self-avatar condition. Participants in the future condition ($M = 8.14$, $SD = 1.53$) showed significantly higher perceived risks, $t(28) = 2.00$, $p = .05$, than those in the no-future condition ($M = 6.84$, $SD = 2.00$).

A significant difference, on the other hand, was found for attitudes toward social smoking, $F(1, 58) = 8.57$, $p < .01$, $\eta_p^2 = .13$ (see Figure 3). Participants in the future condition ($M = 7.94$, $SD = 1.26$) reported significantly stronger negative attitudes toward social smoking compared to those in the no-future condition ($M = 6.81$, $SD = 1.80$). Results for H1c also found significant differences on intention to quit smoking, $F(1, 58) = 6.29$, $p < .05$, $\eta_p^2 = .10$ (see Figure 4). Participants in the future condition ($M = 8.37$, $SD = 1.62$) reported a stronger intention to quit smoking compared to those in the no-future condition ($M = 7.24$, $SD = 1.99$). In sum, although H1a was not supported, H1b and H1c were supported (see Figure 2). With

regard to RQ1, results demonstrated significant effects of seeing future face upon identification with the avatar, $F(1, 58) = 5.39, p < .05, \eta_p^2 = .09$ (see Figure 5). Individuals in the no-future condition ($M = 4.11, SD = 2.29$) more strongly identified themselves with the avatar than those in the future condition ($M = 2.91, SD = 1.77$).

Next the effects of self-avatar use were tested upon perceived risks (H3a), negative attitudes toward social smoking (H3b), intention to quit smoking (H3c), and identification with the avatar (H2). Again, a series of univariate F tests were conducted. The result showed no significant main effect of self-avatar use on any of the dependent variables. For example, there was no significant difference on perceived risks, $F(1, 58) = 1.00, p > .05, \eta_p^2 = .02$, between the self-avatar condition ($M = 7.49, SD = 1.87$) and the other-avatar condition ($M = 7.00, SD = 2.07$). For H3b, avatar type did not indicate any significant effect upon negative attitudes toward social smoking, $F(1, 58) = 0.16, p > .05, \eta_p^2 = .003$, between participants in the self-avatar condition ($M = 7.46, SD = 1.89$) and those in the other-avatar condition ($M = 7.31, SD = 1.40$). Regarding H3c, participants did not significantly differ on intention to quit smoking, $F(1, 58) = 2.90, p > .05, \eta_p^2 = .05$, between the self-avatar condition ($M = 8.21, SD = 1.58$) and the other-avatar condition ($M = 7.43, SD = 2.09$). Finally, there was no significant difference on identification with the avatar (H2), $F(1, 58) = 1.38, p > .05, \eta_p^2 = .02$, between the self-avatar condition ($M = 3.83, SD = 2.44$) and other-avatar condition ($M = 3.21, SD = 1.74$). In sum, the data did not support H3a, H3b, H3c, and H2 (see Figure 2).

H4 explored effects of avatar type upon perceived susceptibility to the consequences of smoking. A t -test indicated that participants in the self-avatar condition ($M = 7.77, SD = 1.26$) reported significantly stronger perceived susceptibility to the consequences of smoking, $t(29) =$

2.78, $p < .01$, than those in the other-avatar condition, ($M = 5.96$, $SD = 2.20$). Accordingly, H4 was supported.

4. Discussion

4.1. Overall Discussion

The current study examined the effects of avatar representations of possible selves (future vs. no future) and physical appearance similarity (self vs. other-avatar). First, the current investigation examined the effects of avatars as visual representations of possible selves and found meaningful results. Individuals in the future condition, who saw and played with the deteriorated appearance as a consequence of smoking, showed more negative attitudes toward social smoking, and greater intention of smoking cessation than the individuals in the no-future condition. Supporting previous research (Brougham et al, 2010), our study finds that showing a future image of a possible self in a concrete and realistic way is an effective method for changing attitudes and perceptions. This study entails important theoretical contributions. First, the study suggests that an avatar can be efficiently used as the visualized possible self by providing more “salient and concrete” information about the future, which can help individuals change current behavior for the sake of future benefits (Trope & Liberman, 2003). This is particularly important because previously studies have found that a decreased ability to envision the future (i.e. future time perspective) significantly affects many areas in health such as substance use (D’Alessio et al., 2003), psychopathology (Wallace, 1956), and risk behaviors of HIV (Rothspan & Read, 1996). Further, it can disrupt even other goal –oriented behaviors and feelings of control (Cohen, 1967; Melges, 1982). Despite abundant evidence stressing the importance of the future time perspective in health behaviors, little was known about how to promote the perspective. Our study demonstrates that an avatar-based intervention may be an efficient way

to help individuals with a low future time perspective, as the results indicate that the intervention can change the perspectives of randomized college students. Given the fact that low time perspective have been linked to socioeconomic disparities in health (Ward, Guthrie, & Butler, 2009), we believe that the effect size of the change among individuals with low time perspective may be bigger than observed here in this manuscript.

There are several issues that are noteworthy. Seeing the future face in the self-avatar condition led to an increase in perceived risks associated with smoking, while no differences in the other-avatar condition were detected. That is, observing the consequences of smoking that other people experienced did not influence smokers' risk perception while witnessing the consequences on one's own body successfully increased perceived risk. This result is important in that it suggests a game using an avatar as a visualized possible self may provide more efficient ways to increase risk perception compared to traditional testimonial-based messaging.

Another interesting result is that individuals in the no-future condition reported stronger identification with their avatar, compared to those in the future condition. It is rather surprising, because individuals in the future condition showed positive changes in smoking-related attitudes (e.g., attitudes toward smoking). This result may be explained with the famous phrase, "Good medicine tastes bitter." In the game, we tried to create the feeling of fear through a realistic photo image of future. The experience of becoming a person suffering from the consequence of smoking may have created the feeling of fear. A natural response, therefore, would be to loosen the connection to the fearful-looking avatar. This bitter experience, however, successfully motivated individuals to develop negative attitudes toward smoking, and more importantly, to determine to quit smoking. At the same time, individuals who were not presented with a distorted appearance were able to focus more on actual game play and therefore might have

become more psychologically invested in the game. Taken together, the results imply that visual representations of avatars in computer games do influence individuals' game experience, as well as post-game attitudes and intentions. Visualizing the consequence of smoking via the aged, wrinkled appearance of an avatar can be an effective method for anti-smoking intervention program. Ironically, such representations make designing educational games much harder than designing commercial games. In commercial games, developers need to focus on entertainment values by including avatars and messages that will please game players. In educational games, developers often need to include messages that game players may not want to see, which is likely to make the game less involving or entertaining. Therefore, it is important to balance game features for entertainment and unappealing messages for education for the successful implementation of educational computer games.

Further, unexpected results were found with regard to self-avatar. Although people reported higher susceptibility in the self-avatar condition, no further differences were found when compared to individuals in the other-avatar condition. One possible explanation may be attributed to "perceived reality." Perceived reality, defined as "the degree of perceived similarity between mediated characters and situations and real life characters and situations" (Shapiro & Chock, 2004, p.677), may affect the ways in which media influence attitudes and behaviors (Potter, 1988). Previous research reported that the level of perceived reality decreased when familiar people or places were presented (Perry, 1987; Shapiro & Chock, 2004). In a similar vein, media dependency theory (Ball-Rokeach & DeFleur, 1976) predicts that media effects on a person's perception of reality decrease, depending on whether a person has personal experience with the media. In our study, it is obvious that one's own face would be more familiar than strangers. Thus, the level of perceived reality in the self-avatar condition might

have decreased, which resulted in making people less likely to change their attitudes and behaviors. That is, participants who played the game with an avatar that had their own face might have felt less connected and more uncomfortable with their avatar.

4.2. Implications

The findings from this study have significant implications for health professionals as well as the scholars interested in future behavior change. First, this study shows that more attention should be placed on social smokers in understanding young adults' smoking behaviors and designing health interventions targeting this group. We believe that more interventions specifically targeting social smokers should be available since they are less addictive to smoking and more responsive to targeted interventions as shown from our study.

In addition, this study suggests that one of the effective ways to provide concrete and specific information about the future that increases the perceived risks and susceptibility of the consequences of smoking is to use an avatar as a visualized and embodied possible self. By utilizing possible selves within interactive virtual environments, health professionals will be able to provide smokers with opportunities to virtually experience their unpleasant future, which may help them change their current smoking behaviors.

Lastly, current findings related to visualized possible selves can be applied to a variety of health contexts that require current behavioral changes. For example, it is applicable to prevent unhealthy behaviors such as substance use and binge drinking. Playing a game to experience a life with obesity or diabetes in the virtual environment may promote healthy eating to prevent obesity or diabetes. We expect that further application and development of the visualized possible selves would expand the area of fear appeal research.

4.3. Limitations

There are a few limitations in this study. The current study is limited to examining the effects of an educational game as a media format. To better examine the unique effect of a game as a health intervention tool, future studies need to assess the effectiveness of a game compared to other forms of media (e.g., text or photo). For example, unlike traditional media, a video game provides an interactive environment to enact various roles (e.g., future life, some else's life) within the game context. Thus, it would be meaningful to test how these features of video games make contributions for effective health interventions by comparing the effect of game play in which individuals experience their possible future self through a visualized and embodied avatar, compared to merely looking at a picture of a possible future self.

The current study examined only the short-term effects of an educational game. Given that most of anti-smoking interventions are campaigns for long-term effects, the game needs to be further developed to include multiple levels and more game features to attract smokers to come back and play the game for a longer period.

Third, given that the current study did not find significant effects of self-avatar, more research is required. For example, a future study could test if there are different effects when avatars are represented in different levels of perceived reality such as photo-based, animation-based, or mixed. In that way, further information can be gathered about the strength of perceived reality hypotheses in identifying which format of avatar can maximize changes in attitudes and behaviors. Finally, we also want to note that there may be a potential sample bias because not all qualified individuals participated in the study.

4.4. Conclusions

The study examined the effectiveness of an anti-smoking educational game in which young adults could not only see the vivid image of their own face deteriorated by the

consequences of smoking but also *play as* the character with an aged, wrinkled appearance. The researchers examined the impact of game play in a variety of conditions on changes in attitudes and behaviors regarding smoking cessation. We believe that *visualized possible self* can help health professionals design more effective health campaigns and interventions, which also calls for more research and applications in other domains.

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Figure 1. “Super smoky” game designed for the anti-smoking intervention.

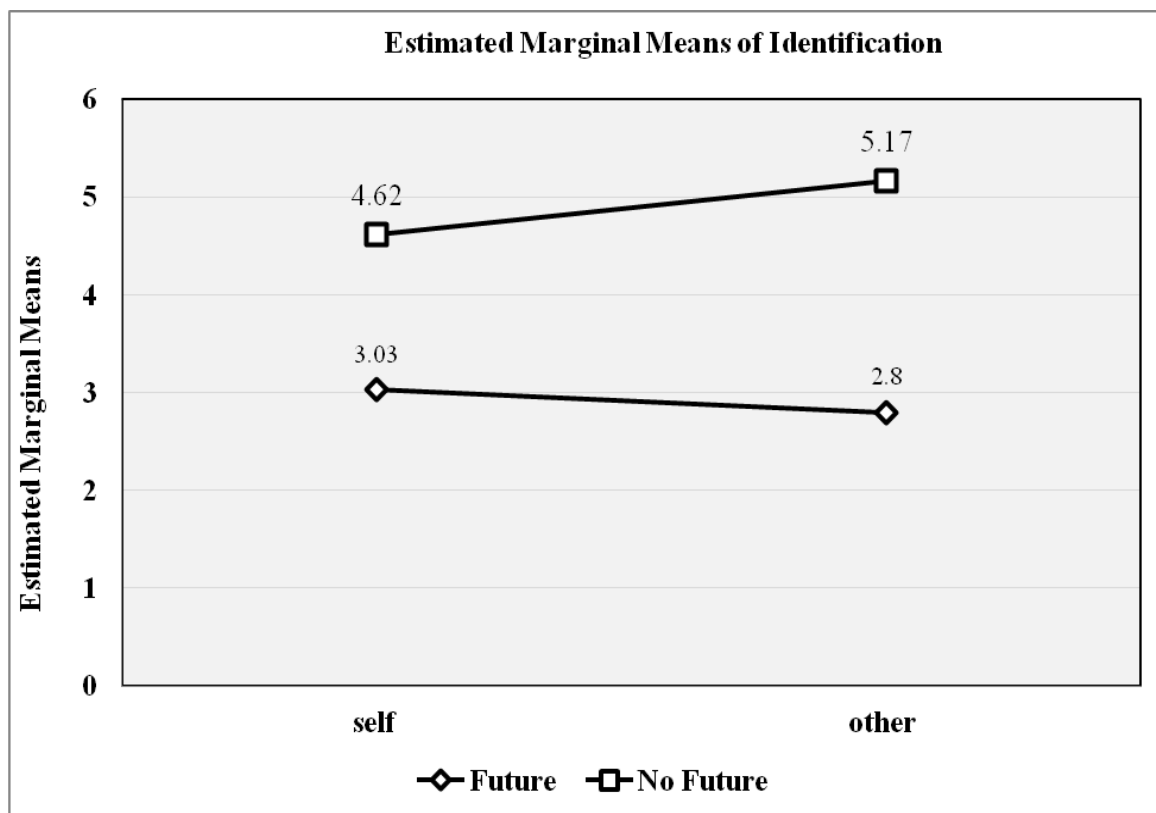


Figure 2. Effects of future face and self-avatar on identification with the avatar.

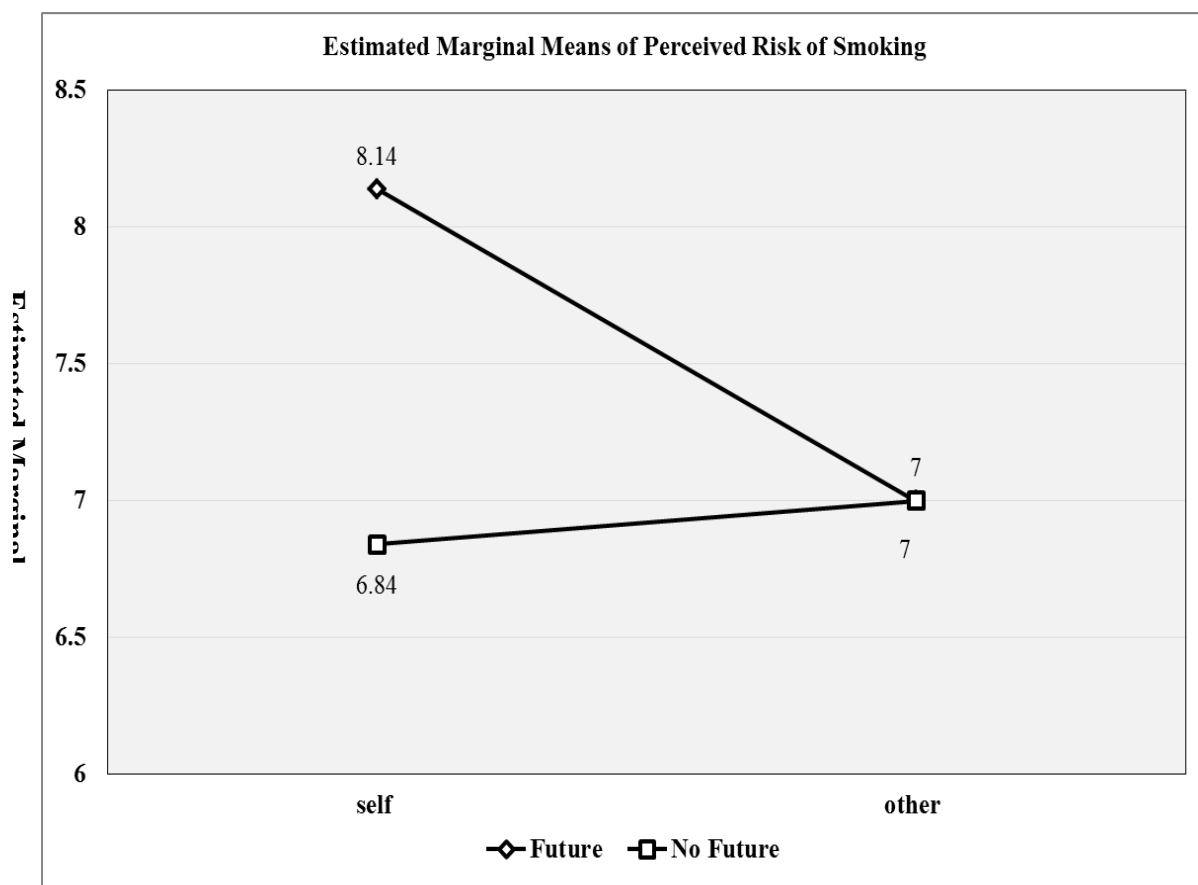


Figure 3. Effects of future face and self-avatar on perceived risks of smoking.

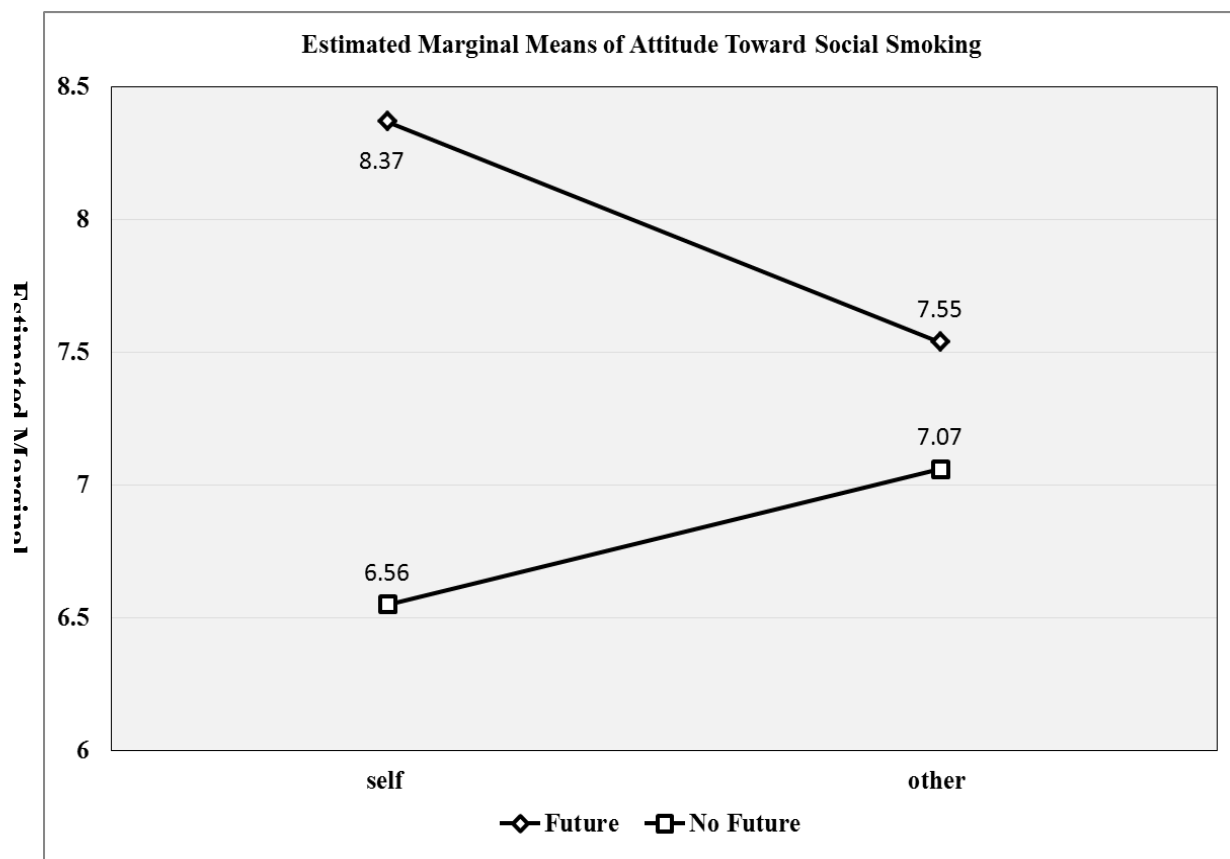


Figure 4. Effects of future face and self-avatar on attitudes toward social smoking.

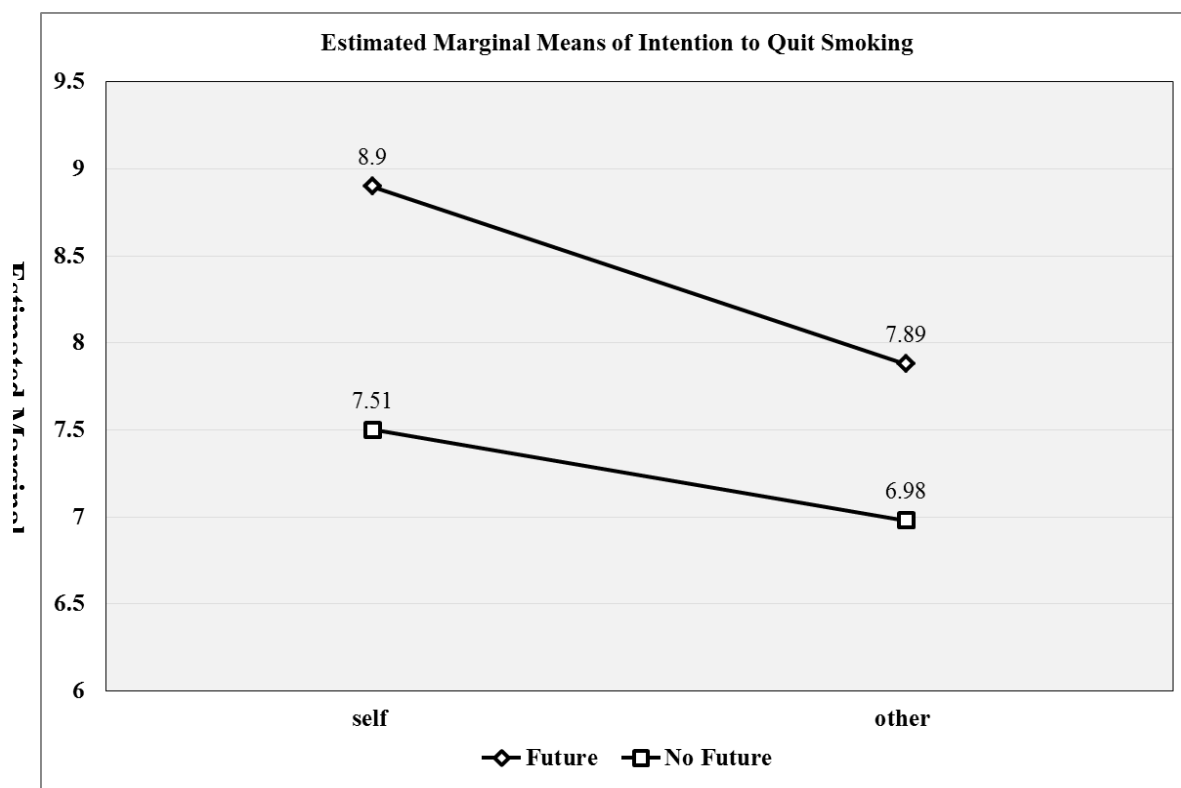


Figure 5. Effects of future face and self-avatar on intention to quit smoking.