The Effects of Serious Games' Genres and Frequency of Exposure on Children's Dietary Preferences

Research-in-Progress

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Abstract

Information technology artifacts can help to engender health behavior change but not enough is known about how to effectively do so. Despite the attractiveness of serious games for health promotion, we still lack an educational, theoretically founded and evidence-based framework to explain their pedagogic effectiveness and the extent to which transformative learning (health behavior change) takes place in serious games. Motivated thus, this study assesses the role of two serious games genres: simulation and puzzles in eliciting a sustained health behavior change and the moderating role of frequency of exposure on the effectiveness of these serious games' genres. The effects of the serious games' genres and the moderating role of frequency of exposure will be examined in a lab experiment.

Keywords: Serious games, gaming, health behavior change, transformative learning, attitude

Introduction

Obesity is one of the leading causes of preventable deaths worldwide. In high-middle income countries, obesity is linked to more deaths relative to underweight (World Health Organization 2016). Building a learning driven automaticity to healthy dietary choices at an early age is the key strategy to combat this epidemic. This is evidenced by recent studies in health promotion—preferences formed in childhood tend to be maintained into adult life (Delgado-Noguera et al. 2011), exposure to advertisements in childhood leads to biased product evaluations in adulthood (Connell et al. 2014) and overweight children are more likely to grow into overweight adults (Dehghan et al. 2005). According to recent statistics, one in five children and adolescents aged 5-17 years in a number of high-middle income countries are overweight or obese (Organisation for Economic Coorperation and Development 2016). To tackle this conundrum, different persuasive interventions have been proposed to motivate children's dietary preferences.

Face-to-face meetings and snail-mail intervention materials (Bhattarai et al. 2013; Neville et al. 2009) have been used in the past but were proven to be less effective compared to technological modalities due to the necessary deployment costs and effort (Shaw and Bosworth 2012). Technological modalities—text-based messaging (Head et al. 2013), social media and mobile apps (Brusse et al. 2014), computer-tailored interventions (Neville et al. 2009), board games (Viggiano et al. 2015) and serious games (Baranowski et al. 2003; Baranowski et al. 2011; Baranowski et al. 2008; Giunti et al. 2015) have a greater, far-reaching capacity and allow for manipulations of health message designs in terms of personalization, frequency, formatting, length of messages etc. (Shaw and Bosworth 2012) relative to traditional health promotion interventions.

In this study we focus on serious games. Serious games are video games that use entertainment to further government or corporate training, education, public policy, and strategic communication objectives (Charlier et al. 2016). The booming use of video games among children (Yang et al. 2015) and their acceptance among adults (Tian et al. 2014) has made this avenue attractive to educators and health promotion practitioners. This is particularly because as opposed to other technological modalities, serious games can support multi-sensory cues, active, experiential and problem-based learning with immediate feedback (Jiang and Benbasat 2007; Yang et al. 2015). These affordances engender meaningful learning (Mayer and Moreno 2003) through the processes of constructivist learning and minimized cognitive load (Mayer and Moreno 2003; Mayer et al. 1999). Also, interactions with serious games allow players to build associations between health behaviors and outcomes (Tian et al. 2014) which influences their beliefs and behaviors (Bandura 2001; Mitgutsch 2011).

While serious games are appealing, empirical research investigating their effectiveness in health behavior change still lags in four critical aspects. First, most research on serious games for health promotion use commercially available video games (Baranowski 2015) that make it complex if not impossible to tease out what features of the games elicit the health behavior change. Second, there is a broad range of serious games including adventure, puzzle, 3D and 2D simulation games such that health promotion can be approached from different game genres. However, prior research has focused mainly on how serious games as a modality perform better than other media in elicitation of health behavior change (Wouters et al. 2013). We posit that the effects of serious games on health behavior change may be more complex and nuanced—some genres may be more apt for health promotion (Breuer and Bente 2010; Wouters et al. 2013). Third, many studies employing serious games rarely examine whether serious games result in sustained behavior change, in most research, behavior change is evaluated subjectively via questionnaires after exposure to the game (Breuer and Bente 2010; Giabbanelli and Crutzen 2015; Giunti et al. 2015; Wouters et al. 2013). Research is therefore warranted to provide evidence for actual improvement in health knowledge and sustained health behavior change engendered by serious games. Fourth, prior literature has argued that virtually formed associations can be expanded to real life contexts and through which the game is able to foster transformation on the players' beliefs (de Freitas and Liarokapis 2011). It is, however, not clear how this expansion occurs.

Departing from prior literature, this study seeks to investigate the effects of serious games genres in eliciting sustainable health behavior change. We also assess the moderating role of frequency of exposure on the effectiveness of these genres. While repeated exposure to games can reinforce learning (Bandura 2001), and plausibly elicit the expansion of virtually formulated associations between health behavior and outcomes to real life, it can cause boredom (Baranowski 2015) which would inhibit learning and health

behavior change. Hence our research questions for this study are: *How is health behavior change affected by different genres of serious games? How does the frequency of exposure to the game moderate the impact of serious games on health behavior change?*

The remainder of this paper is arranged as follows. We first synthesize a diverse body of literature explicating serious games and their link to health behavior change. Next, we present our research model, hypotheses, methodology and conclude with potential implications and our research roadmap.

Literature Review

Serious Games and Pedagogical Effectiveness

The increasing need to create more engaging educational practices and the pervasiveness of gaming have led to the emergence of serious games as a new form of education, training (Ma et al. 2011) and health behavior change modality (Baranowski et al. 2008). While these games are accepted by different age groups (Tian et al. 2014), numerous characteristics of serious games match the learning styles of "digital natives" who generally prefer visual and "play" learning than older age groups (Charlier et al. 2016). Surprisingly, the widespread interest in serious games has not been balanced with a robust discussion of their effectiveness especially since the element of play triggers doubts in practice regarding serious games' pedagogical effectiveness and their effects on transformative learning (Mitgutsch 2011).

In serious games, learning takes place on different levels and in a variety of ways (Mitgutsch 2011). First, as a multimedia environment, messages in serious games are presented in more than one sensorimotor channel such as the auditory and visual channels (Jiang and Benbasat 2007). As the cue summation theory postulates, using multiple sensory cues enhances learning performance such that learning is more effective when the number of available cues increases (Severin 1967). Second, serious games promote "situated learning" which enables players to learn through exploration (Giunti et al. 2015). This exploration allows players to learn vicariously and vividly realize medical complications or consequences engendered by unhealthy lifestyles and progression thereof in a reality realm (Tian et al. 2014). Third, serious games have the potential to lessen the cognitive overload in learning. Given the severe limitations of a learner's capacity for cognitive processing (Mayer and Moreno 2003), especially in younger children (Fry and Hale 1996), the element of "play," in serious games allows for a reduction in cognitive overload.

There is a significant debate between game designers and educators with regards to the role of pedagogy in serious games (de Freitas and Liarokapis 2011). Educators argue that pedagogy needs to be the central aspect in game design (de Freitas and Liarokapis 2011) while game designers argue that the "play" component of serious games should take precedence (Zyda 2005). This debate is exacerbated by the lack of an educational, theoretically founded and evidence-based framework to help build an understanding of how learning and behavior change occurs in serious games (de Freitas and Liarokapis 2011).

Serious Games and Health Behavior Change

In health promotion interventions, the fundamental goal of serious games is to elicit transformative learning (de Freitas and Liarokapis 2011). In order for transformative learning to occur, health knowledge must increase and attitudes formed during the game must be stable and transcend the "second-life" to real-life. As players interact with the game, new associations between health behaviors and outcomes will be formed. As new associations are formed and strengthened throughout the game, players' beliefs and attitudes will be transformed during the game (Mitgutsch 2011). Further, due to the level of realism in serious games, these beliefs and attitudes will be made salient in real-life contexts when players encounter the formed association cues.

In conclusion, prior literature has divided serious games' research into three facets. First, the value-added approach questioning how specific game features foster learning and motivation (Wouters et al. 2013). Second, is a cognitive consequences approach which investigates what players learn from serious games (Wouters et al. 2013). Last is a media comparison approach which compares serious games with other media (Charlier et al. 2016; Wouters et al. 2013). This study contributes to this stream of literature by demonstrating that some genres of serious games are more appropriate for health behavior change as well

as demonstrate that while the frequency of exposure to the game may reinforce learning, it also elicits negative affect for the games which will inhibit health behavior change.

Research Model and Hypotheses

Drawing on the reviewed literature, the research model for this study is shown in figure 1. In this study, we examine the effectiveness of two types of serious games' genres on health behavior change: puzzles and simulation.

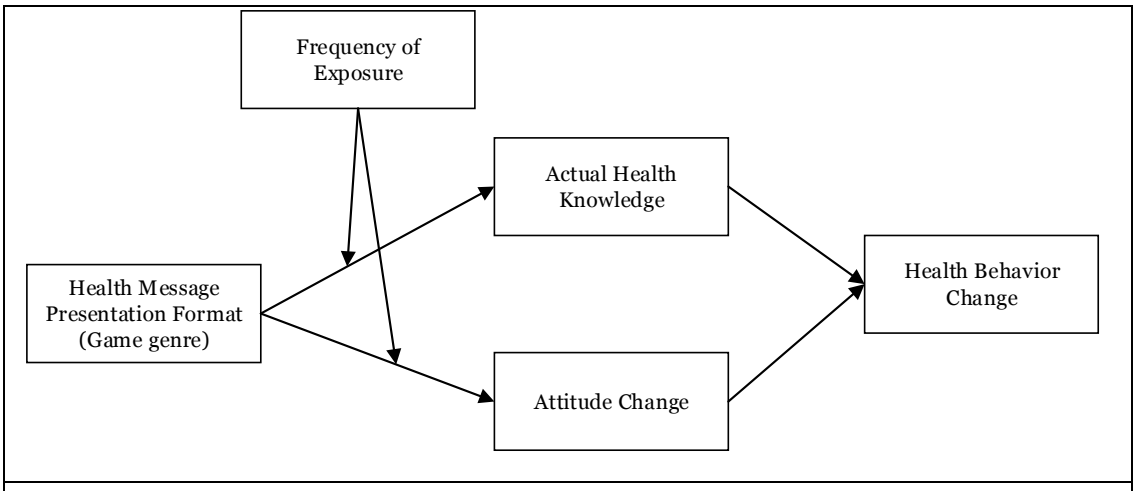

Figure 1. The Proposed Research Model

Game genre provides an established classification of entertainment games (Connolly et al. 2012). While there is no universally accepted taxonomy of serious games' genre, the most popular genres are simulations/ role-playing, action games, and puzzles (Breuer and Bente 2010; Connolly et al. 2012). Action games[1] are reaction based games (Connolly et al. 2012), for example, shooting games which though popular, are not relevant for our study context of health behavior change. We, therefore, focus on simulation and puzzle serious games.

Simulation games are realistic (life-like) training environments (Ives and Junglas 2008) where users are represented by avatars through which they are able to interact with other objects and the environment in real-time (Wasko et al. 2011) in either 2D and 3D virtual environments. *Puzzle serious games* simply involve solving logical puzzles to progress through the virtual world (Connolly et al. 2012) and examples of puzzle games are "my plate jigsaw puzzles[2]" and "the interactive food pyramid[3]". All these genres (puzzles and simulations (2D and 3D)) employ visual and audio effects and as such would elicit multiple cues that aid learning (Jiang and Benbasat 2007; Severin 1967).

Our main dependent variable is *health behavior change* and in the context of dietary habits, it is the extent of healthy food consumption over a significant period of time. Two major mediating variables in this study are *actual health knowledge* and *attitude change*. First, *actual health knowledge* was adopted from Jiang and Benbasat (2007) and tailored to fit our context, it refers to the extent to which players actually understand the health message disseminated via the serious games. Second, we define *attitude* as "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a

[1] It is important to differentiate between action games and Exergames. Exergames are serious games whose purpose is to increase physical activity- a player has to physically move during the game (Baranowski 2015).

[2] http://www.nourishinteractive.com/kids/healthy-games/14-pyramid-puzzles-healthy-foods-messages

[3] http://www.nourishinteractive.com/kids/healthy-games/13-interactive-food-pyramid-five-food-groups

given object." (Ajzen and Fishbein 1975). A*ttitude change* in our current context refers to players' transition from negative to positive attitudes with regards to consumption of healthy foods. In our study domain, attitude is important because first, it helps to manage and simplify information processing tasks (Pratkanis et al. 2014). This means that if players' attitudes toward the serious game are favorable, information processing would be simplified and pedagogy effectiveness would be ensured. Second, the primary function of attitude is to guide behavior (Pratkanis et al. 2014) and doing so through behavioral intentions (Ajzen and Fishbein 1975). In that regard, as players interact with the game, associations between health behaviors and outcomes would be formed, as players' beliefs are transformed through the formation of these associations (Mitgutsch 2011), positive attitudes toward healthier choices would be developed thus influencing healthier actions.

We also investigate the moderating role of *frequency of exposure* to the serious game. *The frequency of exposure* refers to the number of times a player is exposed to the serious game.

Puzzles vs Simulation Games

In puzzles, a player employs the exocentric navigation which means that they are outside the environment, looking in (Kozhevnikov et al. 2008). For example, when playing "my plate jigsaw puzzle", the player merely uses the mouse to click and drag pieces together to complete the puzzle but remains peripheral to the game. However, in simulation games, players in the form of an avatar, interact with the virtual environment in a life-like manner. The player is disembodied and re-embodied as the avatar (Belk 2013) and in most times they assume the identity of the avatar (Belk 2013; Wasko et al. 2011). Prior research has found that characteristics of telepresence and cognitive absorption (Agarwal and Karahanna 2000)) in simulation games lead to positive responses with regards to intention to purchase (Animesh et al. 2011) and increased learning (Nah et al. 2011; Trevino and Webster 1992). In the same vein, we contend that through telepresence and cognitive absorption, simulation games will lead to a deep formation of associations between communicated health behaviors and outcomes, these associations would elicit a change in beliefs and consequently attitudes and health behavior (Bandura 2001; Kozhevnikov et al. 2008).

The re-embodiment as the avatar allows players to "think like the avatar," which contributes to a formation of stable attitudes. Given that attitudes are likely to be stable if the environment they are formulated in is similar to the environment of their activation (Schwarz 2007), we contend that simulation games provide a level of realism that allows a formulation of stable attitudes necessary for transformative learning. This is in line with dozens of psychological experiments that has found that people change after spending even short amounts of time "wearing" an avatar (Belk 2013). For example, prior research has shown that "wearing" a physically fit avatar makes people exercise more (Blascovich and Bailenson 2011). Having established the superiority of simulation over puzzle games, we now turn to 2D vs 3D simulation games.

2D Simulation Games vs 3D Simulation Games

Prior literature has found that 3D simulation games are highly immersive (Animesh et al. 2011; Nah et al. 2011) relative to 2D simulation games. These immersive environments allow for encoding from an egocentric frame of reference (Kozhevnikov et al. 2008) where a user's perceptions of telepresence are heightened (Nah et al. 2011). We argue that this feeling of realism derived from a sequence of high resolution and stereographic images allows for a formation of stronger associations between health behaviors and outcomes and thus will help to improve players' knowledge of the disseminated health messages.

Furthermore, according to Schwarz (2007), attitudes are formed when the relevant context is kept constant, we contend that in a 3D simulation environment, as players encode from an egocentric frame of reference in a higher realism setting, players should be able to transfer virtually formulated associations to real-life. Implying therefore that, beliefs and attitudes towards the virtually formed associations between health behaviors and outcomes would be made salient in real-life context when players make health (dietary) choices.

Although 3D simulation environments are both appealing to players and richer in visual information, research has provided inconsistent evidence regarding their pedagogical effectiveness (Kozhevnikov et al.

2008). While some streams of literature demonstrate that the highly interactive and richness of 3D environments are a distraction from focusing on the provided information (Nah et al. 2011) and elicit cognitive overload on players (Richards and Taylor 2015), some demonstrate that the effectiveness of 3D environments is task or context dependent (Van Orden and Broyles 2000). According to Van Orden and Broyles (2000), in air traffic control, 3D simulations are best suited for collision avoidance. In health promotion, the highly interactive and richness of 3D simulation games may be a double-edged sword. 3D simulation games may elicit a formation of strong associations between health behaviors and outcomes and as such increase pedagogical effectiveness and a change in attitudes, paradoxically, they may elicit over engagement (Nunes et al. 2015) and serve as a distraction from health messages as well as elicit cognitive overload. We highlight these competing predictions in the following hypotheses:

H1a: Compared to the 3D virtual environment simulation and/or puzzle games, 2D virtual environment simulation games will lead to a higher level of attitude change.

H1b: Compared to the 2D virtual environment simulation and/or puzzle games, 3D virtual environment simulation games will lead to a higher level of attitude change.

H2a: Compared to the 3D virtual environment simulation and/or puzzle games, 2D virtual environment simulation games will lead to a higher level of actual health knowledge.

H2b: Compared to the 2D virtual environment simulation and/or puzzle games, 3D virtual environment simulation games will lead to a higher level of actual health knowledge.

Frequency of Exposure as a Moderator of Game Genre

We concur with Bandura (2001) that values (in our context of healthy dietary habits) can be developed and altered vicariously through repeated exposure to modeled preferences. For example, through repeated exposure to a serious game, players would vicariously learn the need to eat fruits and vegetables and consequences of lack thereof. However, familiarity or at least "too much familiarity" does breed contempt, some literature has found a curvilinear relationship between the frequency of exposure and likability of the stimulus object (Cacioppo and Petty 1979; Reis et al. 2011). This is because over exposure to a stimulus object decreases the pleasure derived from the object over time (Bornstein and D'Agostino 1992; Bornstein et al. 1990). This is well explained by the psychological process of habituation (Redden 2008) which "is a decrease in responsiveness that develops with later presentations p. 437," (McSweeney and Swindell 1999). In that regard, frequent exposure to a serious game results in decreased effectiveness of the serious game in inducing attitude change. In a review, Baranowski (2015) discovered that children's interest in the video games waned after viewing for one week or less.

Additionally, as explained by Redden (2008), satiation usually occurs on the sensory features of an experience—the phenomenon called "sensory-specific satiety" refers to a drop in liking of not only the presented stimulus object but also extends to other similar objects (in terms of color, shape, environment etc.). Due to the telepresence and level of cognitive absorption in simulation games (especially 3D virtual environments), players' attention is more heightened as compared to puzzle games. Given that "sensory-specific satiety" depends on how much people's attention makes apparent the repetition of an aspect (McSweeney and Swindell 1999), the heightened levels of immersion and attention in simulation games will make apparent the repetition of content in the serious game which would reduce liking for the game and hence the health promotion message (Redden 2008). Thus, we hypothesize:

H3: The superiority of simulation games over puzzle games in terms of actual health knowledge and attitude change will be less prominent when the frequency of exposure is high.

Actual Health Knowledge

People's social conceptions are highly influenced vicariously by what they see, hear and read (Bandura 2001). In fact, according to Bandura (2001), all behavioral, cognitive and affective learning can be achieved vicariously by observing people's actions and learning its consequences for them. Via serious games, players get to observe consequences and progression of the consequences of unhealthy habits (in our context dietary habits) through the affordances of serious games such as vividness (Nah et al. 2011; Tian et al. 2014), multiplicity of cues (Severin 1967) and active learning (Jiang and Benbasat 2007). Through all these, players form associations between health behaviors and outcomes and as such the

actual knowledge of the health concerns, causes and consequences increase with continuous interactions with the game. With this knowledge, when players encounter dietary temptations, virtually formed associations between health behavior and consequences will be made salient and as thus influence positive health behaviors. Thus, we hypothesize:

H4: Actual health knowledge will lead to higher levels of positive health behavior change.

Attitude Change

A person's attitude towards an object is fundamentally based on his beliefs about that object. A change of beliefs about the consequences of certain dietary choices will influence people's actions for or against those choices. According to TRA, the primary function of attitude is to guide behavior (Pratkanis et al. 2014) and doing so through behavioral intentions (Ajzen and Fishbein 1975). As aforementioned, prior studies have mainly measured the behavioral intention to change (Baranowski 2015; Baranowski et al. 2011; Baranowski et al. 2008), we posit that in line with Bandura (2001), attitude change will have a direct effect on behavior. Thus, we hypothesize;

H5: Positive attitude change will lead to higher levels of positive health behavior change.

Methodology

This study is still in progress. A lab experiment will be conducted to evaluate our hypotheses. The experimental approach was selected because most prior research on serious games and the effectiveness thereof did not objectively measure health behavior change (Giabbanelli and Crutzen 2015). We intend to objectively measure health behavior change immediately after exposure to the serious game as well as conduct follow-up surveys to measure sustained health behavior change. Our experiment will be a 3 (Health Message Presentation Format (game genre): puzzle vs. 2D simulation vs. 3D simulation) x 3 (Frequency of Exposure: high vs. moderate vs. low) between subjects factorial design.

Serious Games' Design

The serious games will be designed specifically for the study in order to avoid confounds. Our games will include these established gaming elements: narrative context, feedback, score and time pressure (Nunes et al. 2015; Reeves and Read 2013). The game design is as follows:

Upon initiating the games, participants will read, "Welcome to the magic game! The magic cartoon will help you plan your meals! You can only play with the magic cartoon for 20 minutes!" The standard for eye care is taking a break after 30-40 minutes of near work (Health Promotion Board 2016) and so our specified time of 20 minutes is suitable. With regards to the dietary choices, there will be an equal distribution of healthy and unhealthy foods in the games for players to select from. In the healthy foods, we will add well-known fruits and vegetables such as banana, apple, orange, broccoli, carrot, watermelon, papaya etc. while for unhealthy foods we will add well-known unhealthy snacks such as fattening fries, color-coded candy, ice cream, sugary cereal, sodas, and muffins. As mentioned earlier, we will control for type of appeal in all our games. While some studies have found that gain-framed messages appear to be more effective than loss-framed messages in promoting prevention behaviors (Gallagher and Updegraff 2012), some have found that combining fear and gain appeals elicited higher levels of attitude change (Gerend and Cullen 2008; O'Keefe and Jensen 2007). In our context, we adopt the combined framing approach.

A player would have to select their breakfast meals for Monday to Sunday with the help of the "magic cartoon." After a player has finished selecting their breakfast meal for a particular day, they click the submit button. Based on the selection, a score[4] is given and the magic cartoon pops up to explain the score. If a player selects foods whose points is below the threshold, the magic cartoon presents a loss-framed message, "Sorry, you have x% because the (food type x) is (too sugary –for example). Now let me show you why you should not eat (food type x)." The player will be shown graphical, vivid images of a

[4] On the game backend, different foods will be given points based on nutritious value-more points for nutritious foods.

human figure and consequences of eating unhealthy foods such as tooth decay and pain when eating. The consequences will be randomly selected and presented to the player by the "magic cartoon." If the player sets up a breakfast meal whose points is above the threshold, the score will be given and the "magic cartoon" will pop up to congratulate the player, "congratulations! You have selected healthy food and so this is how you will live," and gain messages ranging from happily and attractive kids playing to healthy teeth and body will be depicted. Participants will be prompted to click the start button to play. In the simulation game, players will be in a virtual world, where they would have to walk to a fridge in a home as an avatar to select their meals while in the puzzle game, participants will fit food puzzles to make a choice.

Frequency of Exposure Manipulation

Following the prior literature, participants will either be exposed to the serious game once (low frequency), three (moderate frequency) or five (high frequency) times (Cacioppo and Petty 1979).

Materials and Procedures

Randomly selected participants with age ranges from 6-9 years old will be randomly assigned to one of the 9 conditions-3 (Health Message Presentation Format (game genre): puzzle vs. 2D simulation vs. 3D simulation) x 3 (Frequency of Exposure: high vs. moderate vs. low). A pre-intervention survey adopted from Vereecken et al. (2005) will be administered to assess players' attitudes towards eating fruits and vegetables. After the pre-intervention survey, players would be exposed to the serious games. For those in more than one exposure conditions (3 & 5), the exposures will be 10 minutes apart in accordance with eye care standards (Health Promotion Board 2016).

After all the experiments, participants will be led to a task booth where post-experimental surveys will be administered as explained below.

Measurements

Actual health knowledge will be measured by testing participants with questions related to the information presented by the "magic cartoon" in the games. The actual health knowledge will be calculated as the proportion of the number of correct answers over a total number of questions (Jiang and Benbasat 2007).

Attitude change will be measured by the same scale used during the pre-test, however, the questions will be randomized to avoid bias. The post-survey will be administered to all participants again a month later. To corroborate the participants' responses to the follow-up survey, the same scale will be modified and administered to their parents. The experimental surveys will be embedded within a series of unrelated surveys in order to ensure that participants are unaware of the effect of the manipulation on their subsequent choice.

Upon completion of the surveys, participants will be offered a parting gift and will be asked to choose between a chocolate bar and an apple. Following prior literature (Fishbach and Dhar 2005), the gift selection will serve as the onsite objective measure of health behavior change. We propose that participants in the 3D and/or 2D simulation condition with a moderate frequency of exposure will be more likely to select the apple compared to participants in the puzzle conditions with a high frequency of exposure. Finally, participants will be debriefed and thanked.

Manipulation Checks

The proposed study designs will be pretested. In the actual experiment, we will conduct the following manipulation checks. First, we will introduce a manipulation check to determine the levels of immersion, realism, and telepresence experienced by participants across the three serious game genres. Second, we will introduce a manipulation check to determine the effects of message framing (loss vs gain).

Control Variables

Prior literature highlights other factors that influence healthy eating which we will control for. First, given that onsite health behavior change may be a function of both timing of the previous meal and the content

of that meal, we would capture this information in the post-experimental survey. Second, health behavior change after exposure to the game is a function of many health messages players are exposed to and whether or not they have healthy dietary options to choose from. In that regard, we will also capture the extent to which players are exposed to healthy/unhealthy dietary messages and whether they have sufficient healthy options relative to unhealthy options at home. Third, we control for erroneous play (Nunes et al. 2015) through in-game logging of behavior. Fourth, we control for players' age because some serious game genres may be more appropriate for some age groups.

Potential Implications

Information technology artifacts can help to engender health behavior change but not enough is known about how to effectively do so— specifically by using serious games. This study will contribute to the health promotion literature in three ways. First, the study will demonstrate the pedagogical effectiveness of different serious game genres. Second, the study will demonstrate the extent to which virtually, in-game formulated attitudes can be sustained over time. Third, the study will demonstrate the extent to which different serious game genres influence health behavior change. Fourth, the study will demonstrate how the frequency of administration inhibits or reinforces pedagogical effectiveness and positive attitude formation.

This study will provide some practical implications as well. First, the debate between game designers and educators will be settled through this understanding of which serious game genre provides entertainment without compromising on pedagogical effectiveness and the ability to transform attitudes. Second, the study will provide some insights to health promotion practitioners with regards to the administration of serious games. An understanding of how many exposures are required, to lessen satiation and maximize health behavior change will allow health promotion practitioners to yield the benefits of this lucrative modality.

Research Roadmap

In the future, we would like to explore some individual factors that likely moderate the effects of serious games on health behavior change. First, players' expectations (Giunti et al. 2015) may inhibit or reinforce the pedagogical effectiveness of the game and the formation of positive attitudes. If expectations are set such that players expect to learn through a game, their attention may be heightened throughout the game and as such ensure pedagogical effectiveness and stronger formation of associations between health behavior and outcomes which are found to influence behavior (Bandura 2001; Kozhevnikov et al. 2008). Paradoxically, if a player expects to learn, this might evoke feelings of being restricted and as such elicit psychological reactance (Brehm 1989) which would inhibit learning and attitude change. Second, age may be an important factor— puzzles might be more effective in eliciting health behavior change among older children compared to simulation games. The frequency of exposure may also have different effects on different age groups. Hence, it would be interesting to replicate this study on different age groups.

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