

9-11-2015

Using Video Games to Communicate Health Messages: The Role of Psychological Immersion

Christopher Neil Burrows

University of Connecticut - Storrs, christopher.burrows@uconn.edu

Follow this and additional works at: <https://opencommons.uconn.edu/dissertations>

Recommended Citation

Burrows, Christopher Neil, "Using Video Games to Communicate Health Messages: The Role of Psychological Immersion" (2015). *Doctoral Dissertations*. 868.

<https://opencommons.uconn.edu/dissertations/868>

Using Video Games to Communicate Health Messages:

The Role of Psychological Immersion

Christopher N. Burrows

University of Connecticut, 2015

Immersion in a video game environment provides a promising social marketing framework to communicate health relevant information. The highly immersive nature of recreational games can be used to enhance the effectiveness of health information embedded in the game itself via a model of persuasion I term *Psychological Immersion*. This approach was inspired by work on Narrative Transportation (Green and Brock, 2000) and Telepresence (Minsky, 1980), whereby transportation into fictional narratives increases susceptibility to influence from health messages in fictional texts and presence research has suggested a state similar to transportation exists for virtual environments. I pursued four questions to explore this model:

(1) Is there a moderating role of immersion on persuasion in a virtual gaming environment? The initial test of this question was performed in Study 1, with results illustrating moderation by immersion of the influence of anti-DUI posters on post-test DUI willingness.

(2) What mechanisms account for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings? Drawing from research on counterarguing of persuasive messages and belief priming, two competing hypotheses were tested in Study 2.

Results showed support for suppression of counterarguing.

(3) Should messages be embedded in the high-action or low-action periods of game play? This question was addressed in Study 3 by participants viewing anti-DUI posters in either combat or non-combat oriented areas of the game. Results suggested no overall benefit to placing messages

in high- versus low-action scenes, but did suggest that the persuasive effect of posters were sensitive to placement in gaming scenes.

(4) Do the effects of the model generalize across different types of games and different health-risk domains? In Study 4 anti-DUI and anti-smoking posters were embedded in a third person car racing game, extending results to a new game and new outcome. Posters in this study failed to reduce DUI willingness, but showed some evidence of ameliorating smoking willingness.

These four studies outline a new technique for health message dissemination, provide evidence for the mechanism of its action, and its generalizability to a new health domain and game genre.

Using Video Games to Communicate Health Messages:
The Role of Psychological Immersion

Christopher N. Burrows

B.A., Southern Methodist University, 2007

M.A., University of Connecticut, 2012

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

at the

University of Connecticut

2015

APPROVAL PAGE

Doctor of Philosophy Dissertation

Using Video Games to Communicate Health Messages:
The Role of Psychological Immersion

Presented by
Christopher N. Burrows, B.A., M.A.

Major Advisor

Hart Blanton

Associate Advisor

Kerry Marsh

Associate Advisor

Ken Bowen

University of Connecticut
2015

Acknowledgements

I'm not sure that the process of research ever goes smoothly, but the path I took towards the line of research discussed in this document feels like it has been particularly circuitous and fitful. However, it ended in a good place. I'd like to thank my advisor, Hart Blanton, for being patient and for guiding me towards a research topic that I think is important and in which I feel very personally invested. His help was instrumental from study design to writing. My committee similarly deserves credit for helping make this dissertation possible. I was involved with Kerry Marsh's Virtual Reality lab when I started my studies, and this experience helped point me towards my work with video games. I've since worked with Ken Bowen, whose history with the gaming industry has been very helpful with a research program that relies on participants actually enjoying the games that they play.

I'm also very lucky to have begun my studies at the University of Connecticut at the same time as a talented cohort of students with thought provoking and diverse interests within the division of Social Psychology. Thank you to my cohort for all the support provided, especially early on during my time with the program. In particular, thanks to Justin Mahalak for helping me stay sane on the long commute to Storrs, and to Jessa LaCroix for her help more recently with my own studies and for studies we've jointly collaborated on.

Finally, I would never have been able to make my way through university without the material and emotional support of my family. The other constant source of support I've been able to rely on is my wife, Donya, who has also occasionally offered her technical expertise when needed to complete the games and programs used in the studies described forthwith.

Table of Contents

Introduction	1
Study 1	8
Study 2	17
Study 3	25
Study 4	34
General Discussion	43
Figures	51
Tables	62
References	75
Appendices	85

Using Video Games to Communicate Health Messages: The Role of Psychological Immersion

Synopsis

Video gaming has become a widespread hobby, with the influence of gaming on the people that play them a well-studied topic in psychology. To date, this influence has been studied mostly in terms of the negative influences of videogames, as in research showing heightened aggression, hostility and sexism through video game playing. I suggest that the power of video games to influence thoughts and behaviors can also be harnessed for positive social ends. This dissertation demonstrates the ability of entertainment videogames to deliver persuasive health communications, and it empirically tests a broader model that posits a critical role for *psychological immersion* as a key factor that determines if persuasive messages embedded in virtual gaming environments will shape health cognitions of gamers.

Background

Prevalence of Videogame Use

Harnessing the influence of video games for the purposes of distributing health messages is promising, both because of the number of people that play games and the nature of that audience. The Pew Internet and American Life Project found that that 97% of adolescents (12 – 17) and 80% of young adults (18 – 29) play video games (Lenhart, Jones & Macgill, 2008). Of the young adults in this same survey, 20% indicated that they played video games “everyday or almost everyday,” and with slightly more of the regular gamers being male (55%) than female. In a nationally representative sample of 2,000 households, the Entertainment Software Association estimated that 58% of Americans play videogames, with 51% of US households owning a console or computer dedicated to gaming (2014). Although the average gamer was found to be 30, with a heavy proportion of gamers in every age group, other data highlights that ninety-one

percent of younger people (2-17) play games (NPD Group, 2011). Such findings suggest that videogames will offer a powerful tool for reaching adolescents and young adults.

Evidence of In-Game (Anti-) Social Influence Effects

A broad platform for reaching targeted individuals is of little value if messages delivered via that platform have no effect. Curiously, one of the signs that gaming-based campaigns might exert influences on behavior comes from research showing stable, antisocial and risk-promoting influences of videogames (e.g., Bushman & Pollard-Sacks, 2014; Hull, Brunelle, & Prescott, 2014). With regard to *aggression*, a large literature has shown that violent content in a game leads to specific change in attitudes beliefs and behavior of the game player in the direction of the hostile content of a game. For instance, research by Anderson has demonstrated that playing a violent first-person perspective video game results in increased use of sound blast punishment in a subsequent exercise (Anderson & Dill, 2000). Another study by Dill, Brown, and Collins (2008) has demonstrated that pictures of sexualized women taken from games increase ratings of hostile sexism. Experiments like these suggest a causal relationship between game content and behavior change through the violent content of the game (Anderson & Bushman, 2002; cf., Ferguson, 2007; 2009).

Research has also shown a link between game content and *health-risk behavior*. In a four-year longitudinal study of over 2,700 adolescents who completed all four waves of data collection from age 13 to 18, Hull, Brunelle, & Prescott (2014) found after controlling for prior risk factors (e.g., attitudes and behavior), adolescents who played mature, violent videogames showed increases in a wide range of health-risk behaviors relative to those who did not (e.g., alcohol consumption, aggression, delinquency, smoking, risky sex). The current proposal explores methods of reversing potentially deleterious effects of videogames by answering recent

calls to identify their possible countervailing, health-promoting influences (Granic, Lobel, & Engels, 2014). Just as research has demonstrated that other entertainment media (e.g., TV, movies) can play roles either in promoting or preventing unhealthy choices, so too might the entertainment videogames that could undermine the public health be harnessed to promote healthier choices.

The effects of violent videogames on antisocial and health-risk behaviors suggest additional reasons why videogames might provide an ideal platform for delivering health messaging to young adults: They might be useful for targeting individuals who are at heightened risk, due to their gaming habits. Not only might heightened risk occur through direct influence of mature-themed games on risk-taking tendencies, as suggested in the work by Hull, Brunelle, and Prescott, 2014. Research also suggests that aggression and hostility act as additional, independent risk factors for future health (See Iyer, Korin, Higginbotham, & Davidson, 2010). These analyses suggest that gamers should become a focus of future health interventions and increased resources, with particular focus on gamers who play violent videogames. The very games they play—the games that put them at risk—are the obvious vehicle for creating health campaigns targeted at these individuals. The major limitation to this argument, however, is that research on in-game influence effects has focused almost exclusively on the negative influences of games. However, there is a growing interest in harnessing “serious games” (Blumberg, Almonte, Anthony, & Hashimoto, 2013) as a means of promoting public health.

Prosocial and Health-Promoting Serious Games

Researchers have begun studying ways that interactive virtual learning environments can be utilized to promote the motivations, information and skills relevant to promoting healthier life choices (Culbertson et al., 2012; Ferrer- García et al., 2010; Pempek & Calvert, 2009; Peng,

2009). In a game called “Nicot,” for instance, 91 regular smokers age 18 – 64 were given the task of crushing cigarettes in a virtual 3D game environment (Girard, Rurcotte, Bouchard, & Girard, 2009). Four weeks of this cigarette-crushing task added to a 12-week psychosocial support intervention increased smoking cessation rates by 13% (compared with those who instead played a balloon-popping game). A similar approach was built into *Click City*, an online game that confronted 5th graders with such tasks as driving cars around cigarettes and solving mysteries that highlight the dangers of second-hand smoke (Andrews et al., 2011). A clinical trial of this program in 47 elementary schools indicated it was effective at changing smoking intentions and willingness at a 1-week follow-up. Interventions such as these share parallels with research in other behavioral domains, particularly those that manufacture interactions in virtual worlds to promote the motivations, skills and information that might promote healthy decisions and behaviors (Primack et al., 2012). In one such study, for instance, Christensen and colleagues (2013) had 18-24 year old, HIV-negative gay men engage in a virtual sexual encounter that simulated the interpersonal dynamics in which they might negotiate safer sex. They found that this experience led to a reduction in sexual shame, which in turn predicted reductions in risky sexual behavior at follow-up, when compared to rates in the control condition (and see Downs et al., 2004).

These findings argue for continued efforts to utilize virtual scenarios to promote public health (and see Baranowski et al., 2008; DeSmet et al., 2014), but they each share a limitation in that they demonstrate only the effectiveness of games specifically intended for the purpose of health education and promotion. As such, they do not take advantage of broad reach of commercial videogames that are instead designed to entertain. One reason why health researchers might not have examined the pro-health uses of commercial games is the research

just reviewed – many current commercial games appear to have unintended negative influence on health behavior (Hull, Draghici & Sargent, 2012) and aggression (Anderson & Dill, 2000). However, these unwanted influences of commercial games might be harnessed in much the way positive influences are harnessed in serious games, for positive effects.

Although both research showing antisocial influences of videogames and more recent attempts to harness gaming environments to promote public health are suggestive of the potential that videogames may have as a delivery tool for health communication, there has yet to be an attempt to design a game for the purpose of positive influence rather than education or instruction. Standing in the way of such research, there currently is not a strong theoretical model to guide such applications.

Theoretical Framework:

The Psychological Immersion Model

My dissertation seeks to address the need for new theory to guide game-based health interventions, and it proposes what I term the *Psychological Immersion Model* of virtual-reality based social influence. This model draws on two distinct literatures, one on “narrative transportation,” found in the literature on persuasion and another on “presence,” found in the literature on virtual reality.

Narrative Transportation

The first of these literatures, on narrative transportation, focuses attention on the effects of being immersed in the narrative of a story, with particular focus on the effects of being immersed in fictional narratives (see Green, 2000). “Transportation,” as conceptualized in the persuasion literature, is associated with a reduced tendency to interpret information embedded in stories in terms of self-relevance and a parallel increase in the tendency to be influenced by the

persuasive content of this information. Green and Brock (2000) describe narrative transportation as a state that can occur when individuals are psychologically immersed in a fictional story as a “distinct mental process, an integrative melding of attention, imagery, and feelings.” They further proposed that when individuals feel transported into an imagined world of a story, that they become more susceptible to influence.

In support of this proposal, research does suggest that individuals change their beliefs to be consistent with information (including misinformation) communicated to them in fictional stories (Marsh & Fazio, 2006; Marsh, Meade, & Roediger, 2003; Wheeler, Green, & Brock, 1999). Narrative transportation also has been shown to produce less critical processing of factual assertions (Green & Brock, 2000). A proposed application of narrative transportation has been the use of engaging fictional stories as tools for delivering health communications that might be rejected by members of the targeted population, if they were delivered via more traditional mediums of communication (Green & Clark, 2013; Kreuter et al., 2010; Williams, Green, Kohler, Houston & Allison, 2011). This is a potentially important effect of immersion, as research indicates that individuals more connected to the “real world” during message exposure often are rejecting of health information (e.g., Rogers & Mewborn, 1976; Witte, 1992).

Presence

The second literature of relevance to this model focuses on the concept of *presence*, which is found in the virtual reality literature (Minsky, 1980). Presence occurs when individuals interacting with a virtual world feel “physically present” in the virtual environment and psychologically engaged to the point that they experience virtual events as if they were real (Slater & Usoh, 1993). Unlike the transportation literature, which focuses attention on the effects of a form of immersion on later (“downstream”) processing, the presence literature tends to focus

more attention on the prior (“upstream”) factors that produce presence. For instance, research indicates that presence is heightened for first-person games; i.e., games that give players the sense of directly interacting with and influencing realistic objects in virtual worlds and in games that have three-dimensional features that resemble everyday experience (Tamborini et al, 2004). That said, there is evidence from the research in the presence tradition suggesting that immersion into videogaming environments heightens “downstream” openness to social influence. In consumer marketing, for instance, presence has been shown to promote greater memory of in-game commercial logos and brands (Jeong, Bohil, & Biocca, 2011; Nelson, Yaros, & Keum, 2006). It also predicts greater increases in aggressive thoughts and behaviors among individuals who have played violent videogames (Eastin, 2006).

In summary, two distinct traditions – one in the area of persuasion and another examining the experience of virtual worlds – both suggest that when gamers feel immersed into videogame environments that they might become more accepting of persuasive messaging. I thus propose a model of game-based social influence that posits a focal, moderating role of “psychological immersion,” which I define as a state of mind that occurs when individuals engaging in virtual gaming environments lose themselves in virtual worlds and experience them as if they are real. I use the term “psychological immersion” not to suggest an entirely new construct distinct from “transportation” or “presence,” but rather to draw equally from two research traditions, both of which inform my model.

Dissertation Questions

My tests of the Psychological Immersion Model were oriented around the following research questions:

- 1. Is there a moderating role of immersion on persuasion in a virtual gaming environment?** The initial test of this question was performed in Study 1, with replications in Studies 2 – 4.
- 2. What mechanisms account for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings?** The initial test of this question was in Study 2, with a replication in Studies 3 and 4.
- 3. Should messages be embedded in the high-action or low-action periods of game play?** This question was addressed in Study 3.
- 4. Do the effects of the model generalize across different types of games and different health-risk domains?** This question was addressed in Study 4.

Study 1:

Is There a Moderating Role of Immersion on Persuasion in a Virtual Gaming Environment?

Overview

College student participants played a first-person shooter videogame and were randomly assigned to one of two experimental conditions. Those in the experimental (graphic-warning) condition played a version of the game that had graphic messages warning against driving under the influence of alcohol (DUI) in background scenes, whereas those in the control condition played a version that replaced these warnings with landscape photos. Following game play,

participants completed a measure assessing their immersion into the gaming environment and their willingness to DUI. The primary prediction was a first-order interaction between experimental condition and immersion, in the prediction of behavioral willingness. Specifically, it was predicted that increased immersion would lead to lower DUI willingness in the experimental relative to control condition.

Methods

Participants. Eighty-four undergraduate students ($M_{AGE} = 19$; $n = 67$ male) were recruited to take part in research on video games for course credit. In this initial test, all were prescreened for enjoying first-person shooter games on a five-point bipolar scale via the question, “How much do you enjoy playing action video games (e.g. Halo, Call of Duty, Mass Effect, Resident Evil)?” To participate, all had to rate enjoyment of action games above the scale midpoint; i.e., suggesting an attitude that was higher than neutral. This prescreening was performed out of a concern that those who lacked gaming experience might find the game too challenging, such that they would not be able to attend to the background scenes.¹

Methods. Participants were told that they were going to play a videogame for a study that would help researchers better understand the features of videogames that players find exciting and enjoyable. As presented, their only “goal” was to enjoy themselves during game play. To facilitate this cover story, participants were fitted with an ambulatory blood pressure monitor that they wore during game play (ostensibly so that physiological recordings could be collected, although the monitors were not activated). In the game, participants played as armed police officers who were dropped by helicopter on to the top floor of a government office building that had been overtaken by alien humanoids. They were given instructions to shoot their way through

¹ In subsequent studies, this prescreen was dropped from the procedure and proved unnecessary.

the floors of the building to rescue hostages below. Each floor they worked through was presented as some type of government office (e.g., an armed services recruitment office, a department of taxation), and art was placed on the walls in a manner consistent with the description of that floor (e.g., Army recruitment posters on the wall of the recruitment center). The last floor of the building was presented as an abandoned Division of Motor Vehicles office. This feature of the story provided a context for integrating the DUI posters on the wall of the virtual environment.

Participants in the graphic-warning condition encountered anti-DUI campaign posters on the wall of the DUI offices (see Figure 1). For control participants, these posters were replaced with landscape paintings. The games typically lasted 20-30 minutes, with around 10 minutes spent on the last floor that had the poster manipulation. Immediately after game play, the experimenter stopped the study so that a second experimenter could enter and announce that she was collecting data as part of an unrelated (bogus) survey of campus attitudes and beliefs. The questionnaire handed to them included a number of distracter inventories but on the 12th page, it had a brief measure assessing DUI willingness. After completing this survey, the participants were told that the study on video gaming was to resume and they began by reporting the degree to which they experienced psychological immersion during game play. After these ratings were made, participants were given a full process debriefing and probed for suspicion. No evidence of suspicion was found. Participants often reported that they did remember seeing the DUI posters on the wall when asked, but none made the link between the posters in the game and the questions in the bogus second study.

Measures

Psychological Immersion. Participants reported how immersed they were in the videogame, via an 8-item scale adapted from measures of presence (Eastin, 2006) and narrative transportation (Green & Brock, 2000). Sample items included such questions as, “I felt like I was physically present in the game, while I was playing it.” Responses were made on a 7-point scale that ranged from “not at all,” to “extremely,” with middle anchors of “slightly,” and “quite a bit” (*Cronbach’s alpha* = 0.71).

DUI Willingness. This measure was derived from self-reported willingness to drive under the influence of alcohol. This was chosen based on theory and research suggesting that willingness to engage in the behavior is a proximal predictor of actual DUI in young adults (Gerrard et al., 2008; Gibbons et al., 1998; Ravis, Abraham & Snook, 2011). Research indicates that adolescents and young adults have mostly negative attitudes towards DUI and other risky behaviors (Gerrard et al., 2008). They nonetheless become willing to engage in risky behaviors like DUI when risk-promoting situations present (Gibbons et al., 1998). Participants were asked to consider a number of different scenarios in which they had the opportunity to drive home after having had a number of alcoholic drinks (e.g., “If I was feeling slight effects from having a few alcoholic drinks but not yet out of control, I would be ____ to drive”). They rated their willingness to drive on 13-point scales that ranged from “extremely unwilling” to “extremely willing,” with responses scored such that each would have a low value equal to 0 and with higher scores indicating a greater willingness to drink and drive (*Cronbach’s alpha* = 0.81).

Results

Descriptive Analyses. Participants reported levels of psychological immersion that were above the scale midpoint ($M = 4.24$; $SD = 1.24$) and that did not differ by experimental

condition, $F < 1$. Tests of the influence of participant sex revealed no statistical interactions with experimental variables and so this variable was dropped from analyses. There were insufficient numbers to test for effects on different ethnicities but no differences were observed between White and minority participants, and so ethnicity was also dropped from analyses.

Theory Test. To test the primary prediction of the model, willingness to drive under the influence of alcohol was regressed on experimental condition (0 = control and 1 = anti-DUI warnings) and psychological immersion (in the first block) and the multiplicative cross-product of these two variables (in the second block). Results are shown in Table 1. This revealed only a significant interaction between psychological immersion and experimental condition, $B(77) = -0.85$, $t(77) = -2.55$, $p = .01$. As shown in Figure 2, the nature of this interaction was such that, in the control condition, higher immersion was associated with greater willingness to drive under the influence of alcohol, $B(77) = 0.75$, $t(77) = 2.24$, $p = 0.3$. There are two likely accounts for this. Given the influence of risk-conductive games on risky behaviors (Hull, Brunelle & Prescott, 2014; Hull, Druaghici, & Sargent, 2012), it could be that even a single instance of immersion into a violent videogame resulted in greater willingness to engage in risky driving. Alternatively, it may be that the ability to feel immersed into a violent game is reflective of other stable individual difference factors that are predictive of willingness to drive, including a history of violent videogame play.

Regardless of the interpretation, this simple main effect of immersion in the control put the effect in the graphic warning condition in sharp relief. In this condition, the effect of immersion trended in the opposite direction, $B = -0.45$, $t(77) = 1.44$, $p = .15$. As a result of these differing influences of psychological immersion across the two conditions, those who reported high immersion into the game trended towards being less willing to drink and drive under the

influence of alcohol in the graphic warning condition than the control condition, $B = -1.18$, $t(77) = 1.84$, $p = .07$. Interestingly, those who were low in immersion into the game showed an increase in DUI willingness in the graphic warning condition compared to the control condition, $B = 1.20$, $t(77) = 1.89$, $p = .06$. This effect might highlight a common danger of including heavy-handed and graphic warnings such as the ones used in this study. Such messages can at times backfire and produce a boomerang effect (e.g., Leventhal, 1970; Rogers & Mewborn, 1976). It appears from this initial test that, to the extent a boomerang effect can be generated by these materials, immersion in the game reversed this effect.

Ancillary Results

A range of ancillary analyses were performed to address potential concerns regarding artifacts and confounds. All details on these are reported in detail Appendix A. These show the following:

(1) When willingness to drink alcohol (not to drink and drive) was regressed on immersion, condition and the multiplicative cross-product, no effects were observed. This finding suggests that the influence of the posters was specific to the behavior targeted in the posters (DUI) and not to health-risk or alcohol-related behaviors more generally.

(2) No gender difference was detected for reported willingness to DUI. However, significant gender differences existed both for immersion and willingness to drink alcohol in that women were more immersed but less willing to drink alcohol than men.

(3) Age was significantly positively correlated with willingness to drink alcohol and willingness to DUI. However, age was not significantly correlated with immersion.

(4) Although no ethnicity differences were detected for reported willingness to DUI or immersion, significant ethnicity differences existed for willingness to drink alcohol in that White participants reported higher willingness to drink alcohol than participants of other ethnicities.

Discussion

Question 1. Is there a moderating role of immersion on persuasion in a virtual gaming environment? This first test of the role of immersion provided support for the model, although there were some qualifications. Immersion into a violent videogame was associated with greater willingness to drive under the influence of alcohol in the control condition. This effect reversed for those who were exposed to graphic messages warning against the dangers of driving under the influence of alcohol. Although immersion did not result in a statistically significant decline in DUI willingness when this condition was viewed in isolation, this effect was statistically different from the influence found in the no-image control. So strong was this reversal, in fact, that immersion into the game seemed to counteract the “boomerang effect” that has been documented as a concern with some graphic, fear-inducing health campaigns. This finding suggests that psychological immersion might be a useful tool for delivering more forceful and vivid prevention messages that at times can produce defensive reactions. That said, Figure 2 points to a potential danger of attempting to harness immersion into a game. Although highly immersed individuals might be accepting of even the most vivid of risk-prevention messages, those who are not engaged in the game might show the same maladaptive response that communicators work to avoid. Countering this concern, however, it seems likely that if health messages are imported into commercial entertainment games that those who opt in to play

will be individuals who find the games to be highly immersive. If they did not, they likely would seek other games to play.

A potential weakness to this study was the lack of a pre-post measurement design. It is possible that the observed interaction pattern between immersion and condition occurred because participants' higher DUI willingness prior to game play predicted immersion in the DUI condition (and lack of immersion in the non-DUI condition), with prior DUI willingness predicting subsequent DUI willingness. Study 2 addressed this issue by adding a pre-test of DUI willingness. As a consequence of including a pre-test measure of DUI willingness, Study 2 also was able to address the second question of concern in this dissertation.

Question 2. What mechanisms account for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings? Much is left unknown about the underlying cognitive dynamics that might cause immersion to heighten persuasion. My predictions were inspired in part by research linking fictional and narrative processing to persuasion but a closer review of the papers in this tradition reveal a number of hypothesized mechanisms embraced by researchers in this tradition. Study 2 was designed to provide an initial test of two mechanisms that are suggested by these literatures but that nonetheless lead to opposing predictions.

I term the first mechanism *thought disruption*. As noted earlier, researchers have suggested that one of the effects of becoming immersed in fiction or of being transported into a compelling story narrative is that these experiences disrupt the perceiver's ability to engage in normal counter-arguing of counter-attitudinal messages they encounter, leaving individuals vulnerable to persuasion (Baron, Baron, & Miller, 1973; Petty, Wells, & Brock, 1976). Green and Brock's (2000) study pointed to such a possibility by showing that, when instructed to circle

false information in a story, higher transportation resulted in less circling (and see Brusse, Neijens, & Smit, 2010). This finding is suggestive, but it is potentially limited in that the research methods focused explicit attention to counter-arguments in the text. I wished for an approach that tested for potentially spontaneous effects of immersion on persuasion. To this end, I reasoned that, if thought disruption accounts for the effects in the first two pilot studies, it follows that the boost to persuasion should be greatest among those who are most likely to counter-argue, i.e., gamers with prior attitudes that run contrary to the message content they encounter in the gaming environment (e.g., Neimeyer et al., 1991). In my studies, that would be mean gamers that have reasonably permissive attitudes towards DUI. In the third pilot study, I therefore measured attitudes towards driving a car under the influence of alcohol before any participants played the videogame and assessed it again after game play. I hypothesized that, if thought disruption is the mechanism driving immersion effects, then the effect of immersion should be greatest among those individuals who are most likely to counter-argue anti-DUI messages; i.e., those who are favorably disposed towards DUI prior to gaming. With this pre-post design, I could not only test this hypothesis but also address a limitation inherent to Study 1. Namely, I could control for prior DUI attitudes.

This pre/post-experimental design also allowed me to test another plausible but competing hypothesis about the mechanisms in the first pilot study. I term this second mechanism *belief activation*, and it is based on a conceptualization of the graphic images in the games as background “primes” that activate already-held beliefs, which through repeated exposures can promote more consistent attitude expression (Fazio & Towles-Schwen, 1999). This hypothesis is supported by research suggesting that primes are less able to change beliefs or attitudes than they are able to activate preexisting beliefs that individuals already possess

(Bartholow & Heinz, 2006; Stroebe et al., 2008). Research on the processing of fiction also supports the prediction that such an attitude-activation effect should be strongest among those immersed in the game. Prentice and Gerrig (1999) found that fictional texts polarize individuals in the direction of their prior attitudes, rather than their shifting their attitudes in the direction of new or previously rejected beliefs. Instead of lowering resistance to messages among the subset of gamers that would normally reject the message, the hypothesis that follows for such a finding is that immersion should promote persuasion most among gamers that have more positive (not negative) attitudes towards DUI prior to gaming.

It might appear odd to use virtual marketing to “persuade” gamers who already agree with a position represented in a virtual message, but such a scenario is relevant to persuasive health communications designed to promote adolescent health. Research indicates that adolescents and young adults have mostly negative attitudes towards DUI and other risky behaviors (Gerrard et al., 2008). They nonetheless become willing to engage in risky behaviors like DUI when risk-promoting situations present (Gibbons et al., 1998). The challenge for health communicators, according to this perspective, is to reinforce the preexisting, pro-health, anti-risk attitudes that most adolescents and young adults already possess, rather than to counter-argue opposing views. It may be that immersion into virtual gaming worlds is one mechanism by which prior health-promoting beliefs can be activated such that they will more likely influence later decision making.

Study 2:

What mechanism accounts for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings?

Overview

Study 2 was designed to test two competing hypotheses. One is the *thought-disruption hypothesis*, which posits that immersion will interact with prior DUI attitudes, such that it will increase susceptibility to persuasive messaging among individuals who have relatively permissive attitude towards DUI. The other is the *belief-activation hypothesis*, which posits that immersion will interact with prior DUI attitudes, such that it will increase susceptibility to persuasive messages among individuals who have relatively negative attitude towards DUI. A critical test was thus performed by utilizing a graphic-warning version of the game utilized in Study 1. Participants played this game in a study that utilized a pre-post experimental design in which prior DUI attitudes were assessed. Individuals then played the videogame, after which they completed a questionnaire assessing post-exposure DUI willingness and followed by a self-reported of immersion into the videogame. Of interest was if the reduction in willingness was most pronounced among those with prior positive or negative attitudes towards DUI.

Methods

Participants. Eighty-one undergraduates ($M_{AGE} = 19$; $n = 61$ male) were recruited for course credit to take part in research on video games for course credit.

Methods. Methods were adapted from the first study, with all participants playing one version of the game in a single-cell design. The videogame was altered such that participants worked their way through five floors of an overrun “Advertising Agency” (rather than a DMV office), with each floor modeled after the ad agency from Season 5 of *Mad Men*. This setup

provided a context for placing marketing images on carousels in different offices. As players moved about the game, they alternated between “action” floors and “safe” floors. On the action floors, their task was to engage in firefights with armed enemies, much as in Study 1. On the safe floors, participants were told that the floor was free of combatants and that their task was to locate extra ammunition and energy cells that would shield against death on the action floors. The game was rigged such that individuals were teleported from one floor to the next, spending exactly 5 minutes on each floor, allowing for greater experimental control than in Study 1. All participants alternated between safe and action floors for the first 4 floors (with half starting on an action floor and half on a safe floor) and with all participants ending in a fifth, high-action floor. As a result, all ended the game experiencing the same high-engagement experience. Anti-DUI posters were only placed on the two safe floors.

A key difference in this study, compared to Study 1, was that, prior to being instructed on how to play the videogame, an undergraduate experimenter entered the lab and requested that participants take a bogus “disagreement inventory.” This questionnaire was developed to provide a covert assessment of prior DUI attitudes. A covert assessment was pursued to avoid tipping participants off to the true nature of the study (i.e., that it was designed to measure change in DUI attitudes) and to prevent responses on the pre-measure from anchoring responses on the post-measure (which could happen if both measures were worded and scaled identically).

Measures

Pre-Test DUI Willingness. All participants completed a bogus “disagreement inventory.” On this single-page questionnaire was a list of 26 actions that were chosen to range in social undesirability. Actions at the extreme low end were chosen to be viewed as undesirable to most anyone completing the inventory (e.g. murder someone in a fit of rage; cheat on your spouse

while you are engaged to be married) but other actions were chosen to range from moderately disagreeable to agreeable (e.g., spanking a child to teach them not to run with sharp objects; boiling a lobster for dinner). All behaviors were rated on an 8-point bipolar response scale that ranged at the low end from the value of -6 (*I completely disapprove of this action*), up to the value of 0, which was labeled as *neutral* and on to the highest value of + 1 (*I approve of this action to at least some degree*). Embedded in this questionnaire were four actions that involved driving under the influence (e.g., “Drive a car home from a party after you’re feeling ‘buzzed’ but not drunk,” “help to drive a friend home when you’re feeling some initial effects from having a few alcoholic drinks”). These items were averaged to compute a single estimate of the pre-exposure anti-DUI attitudes (*Cronbach’s alpha* = 0.84).

Post-Test DUI Willingness. This measure was slightly modified from the scale used in Study 1. Modifications were pursued because examination of the data in Study 1 revealed that a number of the items were oriented around such strong situations that few to no participants reported any willingness at all to drink and drive (e.g., “How willing would you be to drive a motor vehicle after you have consumed large amount of alcohol?”). These items were reworded and 6 additional items were added, focusing on willingness to drive while “tipsy” or “slightly buzzed,” as these items showed greater individual variability. More extreme endpoints were also added to the bipolar ratings of this scale, so that endorsement of items could now range from “completely disagree” to “completely agree” (as opposed to just “extremely disagree” and “extremely agree”), modifying the 13-point response scales into 18-point scales. These changes resulted in a slight increase in reliability in Study 2 and a more even distribution of scores.

Participants were asked to consider a number of different scenarios in which they had the opportunity to drive home after having had a number of alcoholic drinks (e.g., “If I was feeling

slight effects from having a few alcoholic drinks but not yet out of control, I would be ____ to drive”). They rated their willingness to drive on 13-point scales that ranged from “extremely unwilling” to “extremely willing,” with responses scored such that each would have a low value equal to 0 and with higher scores indicating a greater willingness to drink and drive (*Cronbach’s alpha* = .96).

Immersion. Participants again reported how immersed they were in the videogame. Items were added from Study 1 (to address an unintended deletion of items in Study 1), such that the scale was now a 13-item scale, again adapted from measures of presence (Eastin, 2006) and narrative transportation (Green & Brock, 2000). Sample items included such questions as, “I felt like I was physically present in the game, while I was playing it.” Responses were made on a 7-point scale that ranged from “not at all,” to “extremely,” with middle anchors of “slightly,” and “quite a bit” (*Cronbach’s alpha* = .87).

Fear. Participants completed three items on the fear they experienced while playing the game (“How anxious did you feel while playing the game?”, “How frightened did you feel while playing the game?”, “How uncomfortable did you feel while playing the game?”). Responses were made on a 7-point scale that ranged from “not at all,” to “extremely,” with middle anchors of “slightly,” and “quite a bit” (*Cronbach’s alpha* = .56).

Results

Pre-test DUI Willingness. The reason for creating a more indirect measure of DUI attitudes to gauge pre-test DUI willingness was a desire to prevent suspicion among participants. Evidence suggested that this attempt was successful. After completing the key DV, all participants were probed for suspicion with an online questionnaire and were given a chance to list what they thought were the key hypotheses in the study. Only one participant gave answers

suggesting that he connected the pretest questionnaire to posttest and so he was dropped, prior to any analyses. In support of the validity of this assessment method, the pre-exposure anti-DUI attitude and the posttest-exposure DUI willingness were strongly correlated, $r(80) = 0.76$, $p < .01$. Of interest, however, was how immersion in the game with anti-DUI messages might affect this relationship.

Test for competing hypotheses. To assist in presentation, I recoded the pre-exposure DUI attitude and the post-DUI willingness so that they both were on the same 0 – 10 numeric metric, prior to any analyses. I next regressed post-exposure DUI willingness on to pre-exposure DUI attitude, immersion and the multiplicative cross-product. As shown in Table 2, this revealed a significant interaction between immersion and pre-exposure DUI attitude, $B = -0.23$, $t(76) = 2.36$, $p = .02$. Better understanding of this interaction can be found from inspecting Figure 3, which maps post-DUI willingness on pre-DUI intention as a function of immersion. One would generally expect that more positive pre-exposure DUI attitudes would predict more positive post-exposure DUI willingness, and this was the case regardless of immersion into the anti-DUI game. However, immersion resulted in a greater reduction of DUI willingness for those with more favorable DUI attitudes than those with less favorable DUI attitudes. This suggests that immersion resulted in the largest effects among those most likely to resist persuasion. The results therefore support the thought-disruption hypothesis and argue against the belief-activation hypothesis.

Ancillary Results

A range of ancillary analyses were performed to address potential concerns regarding artifacts and confounds. All details on these are reported in detail Appendix A. These show the following:

- (1) When willingness to drink alcohol (not to drink and drive) was regressed on immersion, no effects were observed. This replicates the results in Study 1 and suggests that effects are specific to the health behavior targeted (DUI).
- (2) A pre-test measure of psychological reactance was included in this study and was not found to moderate effects of condition.
- (3) No gender differences were detected for pre and post-test reported willingness to DUI, willingness to drink alcohol, or reactance. However, a significant gender difference existed for immersion and in-game reported fear such that women were more immersed than men and more likely to report being frightened by the game.
- (4) Age was not significantly correlated with pre and post-test reported willingness to DUI, willingness to drink alcohol, in-game reported fear, reactance, or immersion.
- (5) No ethnicity differences were detected for reported pre or post-test willingness to DUI, in-game reported fear, reactance, or immersion. However, significant ethnicity differences existed for willingness to drink alcohol in that White participants reported higher willingness to drink alcohol than participants of other ethnicities.
- (6) In-game reported fear was measured after game play and was significantly and positively related to immersion, but it was unrelated to pre or post-test willingness to DUI, willingness to drink alcohol, or reactance. It did not moderate the influence of condition on DUI willingness.

Discussion

Question 2. What mechanisms account for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings? Study 2 explored the nature of the cognitive mechanism that lead to greater susceptibility to influence. A review of the literature on the influence of fictional texts (Gerrig & Prentice, 1996) and narrative transportation (Green & Brock, 2000) on persuasion revealed two distinct but seemingly contradictory predictions about how immersion might heighten persuasion. The “thought disruption hypothesis” predicts that immersion into an engaging and entertaining virtual world can undermine counter-arguing of persuasive messages, which can increase persuasion. This would suggest that immersion studies should increase persuasion most among gamers who hold permissive or even positive attitude towards driving under the influence of alcohol prior to game play. It is those individuals who are most opposed to message content and thus most likely to resist persuasion. In contrast, the “belief activation hypothesis” predicts that immersion in a game promotes greater susceptibility to priming, which suggests that immersion should enhance persuasion most among gamers that have more negative attitudes towards DUI, as these attitudes can then be activated more strongly when individuals are cognitively immersed. Results clearly supported the former hypothesis and not the latter. Study 2 indicated that immersion into the gaming world heightened susceptibility to influence from anti-DUI images among those who held more positive DUI attitudes, prior to game play.

Question 3. Should Messages be Embedded in High-Action or Low-Action Periods of Game Play? The next question pertains to an applied question relevant to communicators who wish to embed health messages into gaming worlds: Where in the game action sequence should messages be placed? Given the moderating effect of immersion found in Study 1, and the

mechanism of Thought Disruption highlighted in Study 2, it might follow that communicators should place graphic health warnings in backgrounds of the most engaging scenes in a videogame. This would mean placing the materials on the walls of virtual rooms where players have to respond quickly and return fire to avoid being shot themselves. Such high-action scenes seem more likely to promote immersion, and so they might produce the greatest persuasion due to their ability to distract (Gilbert, 1991) and prevent counter-arguing among gamers (e.g., Petty, Wells & Brock, 1976). It also seemed plausible that effects of high-action scenes are the ones that maximize concentration and absorption into the gaming experience – what Csikszentmihalyi (1988) termed “Flow.” This psychological state has been suggested as a critical ingredient of “presence” in virtual gaming (Nelson & Waiguny, 2012) and so it might predict less counter-arguing, consistent with the mechanism highlighted in Study 2.

Despite the plausible reasons to expect the strongest effects in the higher-action scenes, there are reasons to make an opposed prediction. It may be that psychological immersion is best conceptualized as a general state that gamers enter into, once they become engrossed in the goals and challenges of playing of a game. Under this interpretation, once gamers become immersed in a gaming world, they experience all scenes in much the same way (provided there are no disruptions to the visual and narrative elements during gameplay). This interpretation could argue for placing the graphic images in the relatively low-action scenes of the game. Such placement would maximize awareness of and attention to the messages and might facilitate comprehension of message content. However, as a result of immersion into the game, this heightened attention and comprehension will lead to greater persuasion. Study 3 was designed to test these competing hypotheses.

Study 3:

Should messages be embedded in the high-action or low-action periods of game play?

Overview

This study experimentally manipulated placement of graphic health warnings into high-action and low-action scenes of a videogame in order to test competing predictions about which placement would lead to greatest influence. As with Study 2, the design included a pre-post measure of willingness and so Study 3 permitted a second test of the competing thought-disruption and belief-activation hypotheses. Moreover, Study 3 included a covariate that could address some of the interpretational ambiguity of Study 2. Immediately before playing the videogame, participants rated their overall enjoyment of first-person, shooter videogames in general. Inclusion of this measure made it possible to statistically control for any association between prior interest in shooter games and general willingness to DUI; thereby addressing a potential artifactual interpretation of results in Studies 1 and 2.

Methods

Participants. Four-hundred forty-five undergraduates ($M_{AGE} = 19$; $n = 248$ male) were recruited for course credit to take part in research on video games for course credit. Participants completed the experiment for course credit to take part in research on video games.

Methods. All participants played the same game described in Study 2, again with both “action” floors and “safe” floors and with participant spending exactly 5 minutes on each floor. All participants alternated between safe and action floors for the first 4 floors (with half starting on an action floor and half on a safe floor), and all ended on a high-action floor so that the final experience in the game was the same across conditions. Crossed with these two variations were three experimental conditions: (1) a *high-action influence* condition, in which the anti-DUI

posters were placed on the first two action floors, (2) a *low-action influence* condition, in which the anti-DUI posters were placed on the first two safe floors, and (3) a *control* condition, in which anti-DUI posters were replaced with landscape art. As the game used only two floorplan layouts, floors designated as high or low action were also crossed with floorplan to test for a possible experimental design artifact. The only other modification was to the pre-test DUI-willingness measure. This was now measured at pre-test (for a subset of participants, as described below) in much the same format as at post-test. In addition, a memory inventory was administered at the end of the experiment to determine if effects of immersion were in any way influenced by attention to and encoding of the anti-DUI posters. In all other respects the methods and timing of the measures were identical.

Experimental Design. The design for this study was a 2 (Condition: High-Action, Low-Action) x 2 (Floorplan: Version 1, Version 2) between-subjects factorial with a no-message control and a pre-post assessment of DUI willingness. Due to limitations in the number of participants who could be assessed at prescreening, only a subset ($n = 257$) had both pre-exposure and post-exposure DUI willingness assessments. As a result, analyses that focused on replicating competitive tests of the thought-disruption and belief-activation hypotheses used the smaller subsample of $n = 257$ participants, whereas tests that examined the influence of condition and floorplan utilized the full sample of $n = 445$.

Measures

Assessments of post-test DUI willingness (*Cronbach's alpha* = .93) and immersion (*Cronbach's alpha* = .71) were the same as in Studies 1 and 2, with modest changes to the

number of items and scale anchors used (see Appendix B). New and altered measures were as follows:

Pre-test DUI willingness. Prior views on DUI were again assessed in the subsample of $n = 257$ participants, but unlike Study 2, this took the form of an entire DUI willingness inventory and this was administered in the second week of the semester, in a separate testing session that was not known to be connected to the researchers conducting the videogame study. (Prior liking of first-person shooter games was also assessed at this time, rather than at the experimental session.) The willingness inventories administered before and after the videogame play were identical, except that the pre-exposure variant assessed DUI willingness on a 12-point scale and the post-exposure variant measured it on an 18-point scale. The two inventories ($r = 0.49, p < .001$) were therefore rescored onto the same 0 – 10 metric as in Study 2.

Memory. A recognition memory test was added to the end of the study for a subsample of $n = 257$ participants, in order to determine if immersion or prior attitude influenced recognition of the graphic images in the game. This was an ancillary question but one that had potential relevance because research on brand placement in videogames indicates that psychological immersion (operationalized in terms of presence) predicts better memory for brands placed in games (Jeong, Bohil, & Biocca, 2011; Schneider & Cornwell, 2005; Yang, Roskos-Ewoldsen, Dinu, & Arpan, 2006). Inclusion of a memory test therefore made it possible to determine if comparable effects occurred with the health campaign materials and if recognition for these images mediated any of the effects of immersion on willingness. This memory test took the form of having participants rate their memory for the image on a scale that ranged from 1 =

“I know I definitely did not see this poster” to 5 = “I know I definitely did see this poster,” with a midpoint of 3 = “no clue.”

Results

Test for replication of Study 1. The first analyses utilized the same regression equation focal in Study 1. DUI willingness was regressed on to prior liking of violent videogames, experimental condition (0 for control and 1 for experimental condition), and psychological immersion (first block) and the multiplicative cross-product testing for an interaction between psychological immersion and message exposure (second block). Results are in Table 3. As before, experimental condition was found to interact with psychological immersion (in block 2), $B = -0.58$, $t(357) = -2.68$, $p < 0.01$. The nature of this interaction (shown in Figure 4) was again that psychological immersion had a non-significant but positive relationship with DUI willingness for those in the control condition, $B = 0.13$, $t(146) = 0.72$, $p = 0.47$, and a statistically significant and negative relationship with DUI willingness for those exposed to graphic warnings, $B = -0.39$, $t(254) = -3.12$, $p < 0.01$. Study 3 therefore replicated the interaction pattern found in Study 1, providing additional support for the psychological immersion model. As with Study 1, there was again evidence of a boomerang effect among those in the low immersion condition.

Test for effect of action manipulation and floor plan. Analyses were next performed on the full sample to examine whether there was any main or interactive effects of condition, immersion and floor plan on DUI willingness. Given the complexity of the design, there is no single acceptable way to analyze results. The strategy I employed was to introduce a set of four dummy variables that treated the control condition as the reference condition and that coded for each of the remaining 4 conditions in the 2 (High Action vs. Low Action) x 2 (Floor Plan One vs.

Floor Plan Two) factorial. Thus, DUI willingness was regressed in the first block on to prior liking of violent videogames, immersion, a dummy code for high action and floor-plan one ($H1$; 0 for control and 1 for high-action poster exposure in floorplan one), a dummy code for high action and floorplan two ($H2$; 0 for control and 1 for high-action poster exposure in floorplan two), a dummy code for low action floorplan one ($L1$; 0 for control and 1 for low action poster exposure in floorplan one), and a dummy code for low action floorplan two ($L2$; 0 for control and 1 for low action poster exposure in floorplan two). In the second block, I included the multiplicative cross-product testing for an interaction between psychological immersion and each of the 4 dummy codes.

Results are shown in Table 4. This shows that psychological immersion did interact significantly with the presence of high-action and floorplan two, $B = -1.00$, $t(357) = -3.04$, $p < 0.01$, and with the presence of low-action and floorplan two, $B = -0.80$, $t(357) = -2.41$, $p = 0.02$. Interactions involving posters shown in floorplan one were not statistically significant. This pattern suggests that the action manipulation did not influence the effectiveness of the graphic warning labels but an unexpected influence of the floorplan did have an effect. It thus appears that, although there was no systematic effect of high versus low action, there nonetheless may be some artistry (or luck) in placing advertisements in a floor. For reasons unclear, one of the floorplans interacted with psychological immersion, whereas another did not. That said, the pattern across high and low action and floorplans one and two were generally in the same direction. This can be seen from inspection of Figure 5. Although the slope of willingness on immersion was most negative in the two conditions that used the second floorplan, all of the conditions that had graphic warnings trended in this direction (with slopes that did not differ

from one another) and this contrasts with the trend towards a significantly positive slope in the control condition, $B = 0.25$, $t(357) = 1.46$, $p = 0.15$.

Test for extension of Study 1. A subset of the 257 participants had a pre-screening survey on DUI-willingness included into the experiment procedure. For this subgroup, the same regression equation utilized in Study 1 was again performed, but now also controlling for prior DUI willingness. Thus, I regressed post-exposure DUI willingness on to pre-exposure DUI willingness, prior liking of violent videogames, experimental condition (0 for control and 1 for experimental condition), and psychological immersion (first block) and the multiplicative cross-product testing for an interaction between psychological immersion and message exposure (second block). See Table 5 for the results and Figure 6 for a graphed representation of this regression. After controlling for the statistically significant effect of prior DUI willingness in Block 2, $B = 1.07$, $t(178) = 10.28$, $p < 0.01$, there was a significant $B = 1.91$ increase in the willingness to DUI among those exposed to anti-DUI graphic warnings condition, $t(178) = 1.99$, $p < 0.01$. However, as before, experimental condition was found to interact with psychological immersion (in Block 2), $B = -0.58$, $t(178) = -2.08$, $p = 0.04$.

Test for replication and extension of Study 2. The next regression analysis was created by taking the key regression equation in Study 2 and adding all interaction terms linking prior DUI willingness, psychological immersion and experimental condition. In this analysis, the two-way interaction between psychological immersion and message exposure remained statistically significant, $B = -0.59$, $t(176) = -2.07$, $p = 0.04$, with no other significant two-way effects, and the equation uncovered a significant three-way interaction between prior DUI willingness, psychological immersion and message exposure, $B = -0.48$, $t(175) = -2.41$, $p = 0.02$ (see Table 6). The nature of this interaction can be understood from inspection of Figure 7. This shows (on

the right panel) a replication of the findings in Study 2, such that the slope mapping pre-exposure DUI willingness onto post-exposure willingness was attenuated to a greater degree, the higher the psychological immersion, although the interaction between condition and immersion was not statistically significant, $t(120) = -1.82, p = 0.07$. In the control condition, this pattern was reversed. Greater immersion into the violent game was associated with a steeper slope of post-exposure willingness on pre-exposure willingness in the control condition, $t(54) = 2.00, p = 0.05$. Findings thus provide additional support for the thought-disruption hypothesis.

Psychological immersion was again found to attenuate the relationship between pre-exposure DUI willingness and post-exposure DUI willingness, but this was only when DUI images were placed in the game.

Memory for Images. Inspection of the memory ratings revealed that participants in the experimental condition were more certain they had seen the images they had actually seen ($M = 2.41, SD = 0.81$) than those they had not seen ($M = 2.22, SD = 0.75$), $t(68) = 2.57, p = 0.01$. However, in absolute terms, the difference on the metric appeared slight and the average recognition scores fell below the scale midpoint for both groups (indicating a tendency for participants to believe they had not seen either the posters that were in the game or the foils). Correct recognition of posters that were seen also failed to correlate with pre-exposure and post-exposure DUI intention and with the measure of immersion – both in terms of a zero-order correlation and after recognition ratings of the foils ($ps > 0.30$).

Ancillary Results

A range of ancillary analyses were performed to address potential concerns regarding artifacts and confounds. All details on these are reported in detail Appendix A. These show the following:

(1) When willingness to drink alcohol (not to drink and drive) was regressed on immersion, condition and the multiplicative cross-product, no effects were observed. This replicates the results in Studies 1 and 2, showing specificity of effects on the DUI outcome.

(2) No gender difference was detected for reported willingness to DUI. However, significant gender differences existed both for immersion and willingness to drink alcohol in that women were more immersed but less willing to drink alcohol than men.

(3) Age was significantly positively correlated with willingness to drink alcohol and willingness to DUI. However, age was not significantly correlated with immersion.

(4) No ethnicity differences were detected for reported willingness to DUI or immersion. However, significant ethnicity differences existed for willingness to drink alcohol in that White participants reported higher willingness to drink alcohol than participants of other ethnicities.

Discussion

Question 1. Is there a moderating role of immersion on persuasion in a virtual gaming environment? The results of Study 3 replicated the moderating effect of immersion on decreasing DUI willingness via anti-DUI poster presentation. Extending the results of Study 1, the moderating role of immersion remained present, even when controlling for prior DUI willingness. This finding further supports a causal role for immersion, showing that the

interaction between immersion and poster presentation was independent of a participant's prior DUI willingness.

Question 2. What mechanisms account for the predicted tendency for Psychological Immersion to heighten susceptibility to graphic health warnings? Further evidence for the Thought Disruption hypothesis is shown in the three-way interaction outlined in Figure 7. In Study 3, the pattern of the regression shown in Figure 3 was only replicated in the experimental condition. Study 3 extended findings from Study 2 by showing that Thought Disruption was reversed in the control condition: without the existence of anti-DUI materials, post-test DUI willingness was highest relative to prior DUI willingness if the participant was highly immersed, but lowest when the participant was less immersed in the gaming environment.

Question 3. Should messages be embedded in the high-action or low-action periods of game play? Results suggest that the design of the level itself, operationalized in this study as the level's floorplan, was important in ensuring the influence of anti-DUI posters in the game environment. However, the role of high-action or low-action during anti-DUI poster presentation was less important, at least in this study. Data from the memory probe given to participants after playing the game suggests that most participants were very poor at remembering details of the posters displayed to them. This may hint at the importance of positioning posters so that they can be seen by game players, and that subtle differences in poster positioning, as between the two different floorplans used in this study, can have surprisingly effects on poster influence. Players may need to meet a threshold of poster time on screen for the influence of the posters to tell. Consequently, manipulation of action in game scenes, whereby players are less likely to explore the virtual environment and thus less likely to look directly at the poster implanted in the game,

might not be the best method of investigating the importance of distraction and engagement's effect on influence.

Question 4. Do effects of the model generalize across different types of games and different health-risk domains? This leaves a final question to be addressed in Study 4. If health communication is to be attempted in a multitude of games, the effects tested in the studies presented so far must replicate in more than just first person shooter video games. Additionally, although DUI is a relevant health behavior to the gamer demographic, other health behaviors could be used, but must be tested first. A good test would be to take a non-violent, third person game, which is still in a popular genre, and attempt to replicate reducing willingness to DUI and another, new health domain.

Study 4:

Do effects of the model generalize across different types of games and different health-risk domains?

Overview

I hypothesize that Psychological Immersion is a phenomenon common to all types of games, and that an immersed participant should be persuaded by health messages regardless of the game that they presented in. Studies 1, 2 and 3 demonstrated and replicated the ability of psychological immersion to enhance health messages, but used the same violent first-person perspective shooting game as the context for message presentation. A first-person shooter was used in my initial studies because it is a common genre of game (Entertainment Software Association, 2014) that most people would likely enjoy and be able to navigate easily. Another popular genre of game is the driving or car racing game. This genre of game also lends itself to in-game advertisement due to the use of banners and road side advertisements in real car racing

events. Consequently, I will test the generalizability of the effect of psychological immersion on health messaging by implanting messages in a car racing video game.

In addition to generalizing beyond one particular genre of game, I also suggest that the effect of psychological immersion should generalize across multiple health message domains. Use of DUI health messages synthesized well with video game research because (1) it is easy to represent the health-risks of DUI graphically, (2) it is a behavior that is familiar to most young adults and so one that might easily be primed in a fast-paced gaming environment, (3) effects of anti-DUI messages are mediated by an easily assessed proximal indicator, DUI willingness, and because (4) it is a risk behavior that is sufficiently prevalent in young adult samples to warrant development of new interventions. Similar qualities to anti-DUI messages are found in health messages based on graphic anti-smoking warning labels, as the four qualities listed above have been shown to also apply to smoking (See Blanton et al, 2014; Azagba, & Sharaf, 2013; Borland et al, 2009; Chang et al, 2011; White, Webster, & Wakefield, 2008). Moreover, as with DUI, smoking appears to be a behavior that is promoted by mature-themed videogames (Hull, Brunelle, & Prescott, 2014), and so it is meaningful to consider ways of counter-acting this antisocial effect by embedding prosocial/pro-health messages in a mature-themed gaming environment.

Methods

Participants. One-hundred-ninety-three participants ($M_{AGE} = 19$; $n = 87$ male) were undergraduate students recruited to take part in research on video games for course credit. Of the total number of participants recruited, 87 were men, 95 were women, and 11 did not answer.

Methods. All participants were pre-tested on a brief measure assessing smoking willingness and willingness to DUI. Similar to prior studies, participants were asked to play a

video game. Rather than a first person shooting game as used previously, the game consisted of a driving game in which participants attempt to win a race while driving a car for fifteen minutes. Participants played the game as sports car race drivers on a tarmac racing circuit and were assigned to one of two conditions (see Figure 9). In condition one, posters in the game were of anti-smoking advertisements. In condition two, posters in the game were of anti-DUI advertisements. Posters were placed on billboards by the side of race track and could be seen during the game by participants as they drove past.

Immediately after finishing the game, the experimenter stopped the study so that a second experimenter was able to enter and announce that she was collecting data as part of an unrelated (bogus) survey of campus attitudes and beliefs. The questionnaire handed to them repeated the pretest brief measure assessing smoking willingness and willingness to DUI. After completing this survey, participants reported the degree to which they experienced psychological immersion during game play, answered questions on fear experienced as a consequence of playing the game, and several ancillary measures.

Measures

Smoking Willingness. Smoking willingness was measured with both pre-screen and post-test measures. The pre-screen measure of smoking willingness consisted of a five item scale, all using a 9-point scale ranging from “completely unwilling” to “completely willing,” with responses scored such that each would have a low value equal to 0 and with higher scores indicating a greater willingness to smoke (*Cronbach's alpha* = 0.82). The measure included items like “If someone offered me a cigarette to smoke in a social setting, I would be _____ to smoke the cigarette.” Post-test, an eight item measure of smoking willingness was used, which included items like “If a friend of mine was smoking cigarettes and offered me one, I would be

_____ to smoke the cigarette.” Participants rated their willingness to smoke on 18-point scales that ranged from “completely unwilling” to “completely willing” (*Cronbach’s alpha* = 0.93).

In-Game Measures. Participant in-game performance and success, measured via the game itself, was also recorded and saved automatically upon completion of the game. These measures consisted of the number of times a participant crashed their car, the participant’s final position in the race (whether they finished first, second, third or fourth), the number of laps they completed in the game’s fifteen-minute time limit, and their total distance traveled.

Results

Deception. Participants were asked what they thought the hypothesis of the experiment was before debriefing. Based on these answers, and specifically whether participants indicated any suspicion that the experiment was about either DUI or smoking, I was able to code for deception. In total, forty participants were not deceived by the experiment’s cover story. Broken down by condition, there were $n = 19$ out of 112 non-deceived participants in the DUI health message condition and $n = 21$ out of 81 non-deceived participants in the smoking condition. This difference by condition was not significant, $\chi^2(1, N = 193) = 2.298, p = .13$, and so non-deceived participants were removed from the following analyses. However, the greater difficulty with deception evidenced in this game is a potential limitation that must be considered when interpreting results.

Test for replication on DUI willingness. To answer whether the psychological immersion effect generalized to a new genre of video game, I tested for a replication of the three-way interaction between pre-test DUI willingness, immersion, and poster condition on post-test DUI willingness shown in Study 3. I regressed post-test DUI willingness (transformed 0 to 10

scale) on pre-test DUI willingness (transformed 0 to 10 scale), experimental condition (0 for anti-smoking and 1 for anti-DUI posters), and psychological immersion in the first block. In the second block I included multiplicative cross-product tests for an interaction between psychological immersion and experimental condition, psychological immersion and pre-test DUI willingness, and pre-test DUI willingness and experimental condition. In the final third block, I included a multiplicative cross-product test for the three-way interaction between psychological immersion, pre-test DUI willingness, and experimental condition. See Table 7 for the results of this regression.

In Block 2 of the above regression, the hypothesized interaction between psychological immersion and experimental condition was marginally significant, $B = 0.48$, $t(141) = 1.81$, $p = 0.07$, although it was in the opposite direction to the previous studies. This indicates that higher immersion was related to relatively *higher* willingness to DUI for participants who saw anti-DUI posters. Block 3 includes the three-way interaction between condition, immersion and prior attitude, $B = 0.39$, $t(141) = 2.74$, $p = 0.01$, which reveals a more complex pattern of results (see Figure 9). This interaction points to a large difference in a participant's willingness to DUI primarily when the participant entered the experiment with high pre-test DUI willingness and was in the anti-DUI message condition in the study. Among these participants, lower immersion predicted lower DUI-willingness than high immersion. This pattern is also opposite that of the prior studies.

Test for replication on smoking willingness. To answer whether the psychological immersion effect on health messages will generalize across health domains, I tested for a three-way interaction between pre-test smoking willingness, immersion, and poster condition on post-test smoking willingness. I regressed post-test smoking willingness (transformed 0 to 10 scale)

on pre-test smoking willingness (transformed 0 to 10 scale), experimental condition (0 for anti-DUI and 1 for anti-smoking posters), and psychological immersion in the first block. In the second block I included multiplicative cross-product tests for an interaction between psychological immersion and experimental condition, psychological immersion and pre-test smoking willingness, and pre-test smoking willingness and experimental condition. In the final third block, I included a multiplicative cross-product test for the three-way interaction between psychological immersion, pre-test smoking willingness, and experimental condition. See Table 8 for the results of this regression.

In Block 2 of the above regression, the interaction between psychological immersion and experimental condition was not significant. This demonstrates a failure to replicate the interaction effect demonstrated in studies that measured DUI willingness, and as such suggests that the effect may not generalize to the new health domain of smoking. However, the interaction between pre-test smoking willingness and experimental condition was significant and in a direction that supported the model, $B = -0.39$, $t(141) = -2.15$, $p = 0.03$. As shown in Figure 10, this effect indicated that, if participants saw the in-game anti-smoking health messages, the relationship between prior and post-test smoking willingness was “flatter.” This finding is consistent with results in Studies 1 – 3, showing a benefit to in-game advertising but it does not reveal a role of psychological immersion.

Moreover, in Block 3, the three-way interaction was also significant, $B = -0.37$, $t(141) = -2.39$, $p = 0.02$. The nature of this result (shown in Figure 11) also replicates the basic pattern in Studies 2 and 3. The figure on the right of Figure 11 shows that immersion into the DUI game resulted in a steeper slope between pre-exposure smoking attitude and post-exposure smoking intention, consistent with findings in the control condition of Study 3. However, when the control

(DUI) images were replaced with anti-smoking images (left hand of Figure 11), the effect of immersion is eliminated. The slope reduction as a function of condition was not statistically significant among those who were high in immersion (measured as 1 SD above the mean) but it did trend in that direction, $B = -0.28$, $t(143) = -1.67$, $p = 0.10$. Thus, the study did provide support for the model advanced in Studies 1 – 3, with the smoking but not the DUI outcome.

Ancillary Results

A range of ancillary analyses were performed to address potential concerns regarding artifacts and confounds. All details on these are reported in detail Appendix A. These show the following:

(1) When willingness to drink alcohol (not to drink and drive) was regressed on immersion, condition and the multiplicative cross-product, no effects were observed.

(2) No gender differences were detected for immersion, or for reported willingness to smoke or drink alcohol. However, a significant gender difference existed for participants' willingness to DUI.

(3) Age was not significantly correlated with immersion, willingness to smoke, drink alcohol, or DUI.

(4) Immersion did not correlate significantly with any of the in-game behavioral measures. However, breaking down the immersion measure into its constituent parts, player position in the race correlated significantly with the Spatial Presence subscale. Though not statistically significant, player position in the race showed a trend of negatively correlating with just the adapted transportation scale.

(5) It may be that, in addition to thought disruption, immersion in mature-themed games produces fear misattribution, which in turn promotes less rejection of fear-based graphic health

warnings. Research indicates that fear aroused by a health message can lead to message rejection (Witte, 1992) and fear can be misattributed to other sources (Ross, Rodin, & Zimbardo, 1969). If so, the interaction of psychological immersion with experiment condition could be mediated by the amount of fear produced by that game. Mediation analysis showed no evidence to support a fear misattribution hypothesis for this study.

(6) Analyses performed on recall indicated that recall for in-game posters did differ by condition, such that anti-smoking posters were recalled more often than anti-DUI posters. Further, condition interacted with immersion, such that recall was worse among highly immersed participants in the anti-smoking condition, but unaffected by immersion in the anti-DUI poster condition.

Discussion

Question 1. Is there a moderating role of immersion on persuasion in a virtual gaming environment? The results of Study 4 failed to replicate the moderating effect of immersion shown in Studies 1, 2, and 3 for DUI willingness. For this criterion, Study 4 demonstrated a moderating effect of immersion in the opposite direction to the other studies whereby DUI willingness was increased under condition of high immersion, and this was particularly the case when anti-DUI posters were presented in the game. When testing for the moderating effect of immersion on smoking willingness, the effect was absent as a first-order interaction between condition and immersion but a consistent result was found in the form of a three-way interaction between experimental condition, immersion and prior attitudes. As before, this effect was in a direction supporting the thought-disruption hypothesis. These findings

suggest that either features of the behavioral domain or the stimulus materials (or both) had consequential effects on the effects of immersion in the driving game.

Question 4. Do effects of the model generalize across different types of games (first-person shooter versus driving game) and different health-risk domains (discouraging driving under the influence of alcohol versus cigarette smoking)? These results suggest that the model of immersion demonstrated through Studies 1, 2 and 3 does not generalize as hypothesized across different game types. Analysis of memory data might suggest an account for this. The tendency for the graphic cigarette warnings to be remembered better than the graphic DUI warnings suggests that the former were more attention-grabbing than the latter. This might point to an important difference in how immersion influences visual focus in the game used in Studies 1 – 3 versus Study 4. With the studies using a first-person shooter game, immersion seemed to heighten influence from anti-DUI messages. Given that this game presented gamers with a “search and destroy” task, immersion in this game might have directed attention diffusely through the room (i.e., to the walls and banners where messages were placed). In contrast, the driving game in Study 4 presented gamers with a driving task, and so immersion in this game might have directed attention to the center of the screen onto the virtual road and away from the billboards. If so, this would explain why the immersion effect reversed for DUI. The memory results also suggest that these images were more memorable, and so it may be that the more visually compelling images in these campaigns were sufficient to override the focusing effect of immersion, such that immersion again increased influence by reducing counter-arguing.

This account will require additional research to empirically test and one promising approach would be to use eye-tracking software during gameplay to determine how immersion influences attention in different games. Research might also manipulate the presentation of the

images in different areas of the visual field (in the center or periphery of the screen) and their visual salience. These findings highlight a point shown before in Study 3, which is that placement of images will need to be given more critical attention in future work. Study 3 showed that small changes in the floorplans of a first person shooter game could change the strength of the relationship between immersion and persuasion. Moving from a violent first person shooting game to a third person driving game was a larger change, and differences in the way in which immersion influences message processing perhaps should have been expected as a result.

These results also suggest that there may be limits to some games that prevent them from being strong candidates for message delivery. Because driving games require players to focus on the road in front of them, this type of game provides fewer opportunities for exploration of the environment compared to a first person shooter game, which is likely to influence the way in which information from in game health message communication is absorbed. In contrast, games that allow first-person navigation of three-dimensional worlds might offer greater flexibility. This reasoning suggests that social marketers who adapt these methods to deliver health campaigns should pilot test any game used and not simply assume that findings with one game will import to another.

General Discussion

The findings in Studies 1 through 3 provided strong support for the psychological immersion model that was central to this set of studies, although findings from Study 4 suggested some challenges that future research will need to examine. I will first discuss results from the studies using the first-person shooter game designed to reduce DUI willingness and then turn my

attention to future research, including the challenges suggested by the driving game used to influence both DUI and smoking willingness.

First-Person Shooter Studies

Studies 1 – 3 provided support for the psychological immersion model, which proposes that (1) immersion into a game heightens influence from health messages implanted within them and (2) that this influence is greatest among those who would be prone to counter-argue health messages (i.e., those with strongly held attitudes in opposition to the health messages). Results of Study 2 suggest that this model can generalize to placement of messages in both high-action and low-action scenes, although differences in effects across floor plans suggests that effects can depend on effective placement of messages in different gaming environments. It is untested at present what makes for the most effective placement. I found no differences in memory for images based on the different floor plans and so, at present, I can only say that there may be some art involved in placing images and that use of this method might require some pretesting to ensure that images are exerting influence.

If messages do exert influence, however, results of Studies 2 and 3 provided evidence that this influence will be greatest among those most at risk – those who are relatively favorably disposed towards engaging in the risk behavior being targeted. This suggests that immersion can disrupt the counter-arguing of persuasive health messages, which could have tremendous implications for future health message campaigns (and see Green & Clark, 2013; Kreuter et al., 2007). As noted with respect to the boomerang effect suggested in findings from Study 1 – 3, one of the great challenges to health campaigns is that higher-risk individuals are often the most resistant to health-promoting communication. Often resistance is so great that efforts to promote health move higher-risk targets toward even more risky choices (Leventhal, 1970; Rogers &

Mewborn, 1976). Findings with the first-person shooter games suggest that when people lose themselves in virtual worlds that they might also lose some of their everyday defenses. Messages delivered virtually might endure after the individual returns to the “real world,” but studies 1 – 3 are limited in this respect as each consisted of a single-trial administration of virtual messages. Future research will need to determine if virtual-world messaging can exert longer term influences on real-world behaviors. I believe that for such effects to occur, it will be important to move towards ways of utilizing virtual environments to deliver health promoting messages over sustained periods of time, as this is often critical to getting health campaigns to exert lasting effects on behavior (Dijkstra et al., 1999; Durkin, Brennan & Wakefield, 2012; Leavy, Bull, Rosenberg & Bauman, 2011).

The need for prolonged exposure points to another potential advantage of a virtual-game approach to message delivery. More than most traditional social marketing efforts and even many new-media approaches that utilize virtual learning environments, campaigns embedded in commercial videogames can offer great opportunities to deliver messages to large groups of adolescents and young adults over longer periods of time. Interestingly, one of the signs that gaming-based campaigns such as these might exert stable and health-promoting influences on behavior comes from research showing stable, antisocial and risk-promoting influences of videogames (e.g., Bushman & Pollard-Sacks, 2014; Hull, Brunelle, & Prescott, 2014). Research on these undesirable effects of videogames suggests that many gamers are spending enough time in virtual gaming worlds to be influenced. This unfortunate result offers evidence that gamers might also spend enough time in virtual gaming environments to benefit from any health-promoting messages embedded in these games. It is not my position that health communicators should develop and market new games to deliver prosocial and pro-health messages via violent

and antisocial gaming formats. Rather, living as we do in a time in which some degree of exposure to entertainment games is normative among adolescent and young adults, it seems critical that the public health community consider the ways in which the exciting virtual landscapes that engage and entertain gamers might be harnessed to deliver health messages.

The prospect of game use for the purpose of social marketing will open new virtual worlds that are currently being inhabited by gamers. Although there may be challenges ahead in getting game-development companies to participate in social marketing campaigns from within the games they produce, these worlds offer an opportunity for “social engineering” that is far greater than ever could be pursued in the actual, physical world in which we live our everyday lives. Suppose, for instance, that a director of a public health campaign living in a midsized city has developed an image-based campaign that has been shown to discourage smoking in adolescents. To launch this campaign, she might pursue cooperation from the local schools and community centers, which can distribute her materials to her target audience. She might work to secure space on billboards that are visible on major thoroughfares, or she might get cooperation from city transit administrators. Such organizations might place her images on the city buses that crisscross the downtown. There will be barriers and costs associated with any one of these approaches to message delivery, and it is unlikely that she could overcome all of them. In contrast, if the researcher placed her anti-smoking materials in a game she would be free to place them practically anywhere, from shelled out buildings and decaying billboards to abandoned transit buses that populate city swept by a future zombie apocalypse. In comparative terms, such virtual real estate is easy to secure.

That said, before any large-scale efforts at virtual social engineering are pursued, there is considerable research that must be conducted to gain a better understanding of how health

campaigns and other social marketing efforts might influence real-world behaviors when delivered via entertainment videogames. I view the results of these four studies as tests of a model of social influence; a model that will require future and systematic attempts at replication and extension. One limitation of the current studies that future research must address is the focus on attempts to influence DUI willingness via anti-DUI graphic warnings. I predict similar effects will be observed for other behavioral domains in which graphic images have been shown to have utility. I see value in game-based delivery of graphic warnings discouraging smoking (Borland et al., 2009), heavy drinking (Agostinelli & Grube, 2002) and risky sex (Struckman-Johnson et al., 1994), and I think games might be used to promote such activities as a healthy diet and regular physical activity, environmental conservation and perhaps more abstract concepts related to social tolerance. Findings from Study 4 already suggest that delivery of graphic anti-smoking warnings via video games will work. However, the appropriateness of videogames in these behavioral domains must be examined critically and it is likely that many concepts that can shape behavior will not translate well into virtual gaming environments.

Finally, research should determine the limits of this medium for delivering complex messages or messages that introduce new or unfamiliar concepts. So far, I delivered messages that were visually attention grabbing and that reminded gamers of a health threat that was already familiar to them. It is less clear that I could have introduced a new health concern, such as the benefits of getting vaccinated against HPV or the reasons for homeowners to conduct radon testing. Even for health threats familiar to these participants, there are likely limits to the complexity of the message employed. For instance, one strategy for lowering problem drinking in colleges is to alter social norm perceptions (Perkins, 2014). Researchers have found many visually engaging graphic displays that can convey the concept of norm misperception and the

errors of logic that might promote problem drinking on colleges. As creative as the visual design of many of these messages are, they require time to process and understand as, by design, they are meant to challenge common assumptions. Gamers may not have time to digest these messages in a fast-paced highly immersive virtual environment. Even if they did, immersion into the game might have disrupted the cognitive processes by which social norming can redirect behavior. These problems would likely magnify if the campaign moved from graphic presentation to text presentation of material.

Future Research and Considerations

We have much to learn about both the promise and the limitations of social and health marketing in virtual gaming environments. Future research will need to better assess how the qualities of a game might interact with features of a message and different aspects of a behavior to alter the link between psychological immersion and persuasion. However, the current studies suggest reasons to begin looking for answers.

Video game playing is increasing in popularity in the US, and although this also increases the relevance of this line of research, greater familiarity with games by gamers, and a consequent loss of novelty, might work to reduce immersion. As gamers spend ever-increasing amounts of time in virtual worlds, the experience could begin to feel mundane, with the possibility that humdrum concerns and boredom begin to invade a previously exciting virtual life. In addition, practice and consequent mastery can rob a game of its challenge, which might lead to a reduction in distraction and engagement. For these jaded gamers, games may no longer be quite so immersive. However, I believe that increases in the technological sophistication of virtual worlds offer a means of keeping games novel and exciting. This technological progress is readily observed in the games industry, wherein more realistic and engaging games are released every

year. Using recreational games for health communication, it will be important to use games with up-to-date graphics, controller hardware, and to keep pace with gameplay innovations.

Presenting a frequent gamer with information imbedded within Pacman will not be a recipe for success.

Future research should examine the different dimensions of immersion and test whether immersion through different means also moderates persuasion. My research has focused on fast-paced, action-oriented games, which suggests that the effects of immersion observed in studies 1-4 have been a function of high-action and eye-catching visuals. Alternative forms of immersion include traditional narrative transportation (Green & Brock, 2000), in the sense of being pulled into a compelling story. This form of immersion may be present in role-playing and other story-driven games. These games often also feature compelling none-player-character driven story-telling, much like an interactive movie, in addition to avatar customization, which is likely to increase gamer's avatar identification. Some role-playing games are online and consist of large virtual worlds inhabited by multiple players. In online games, connections between players and the pursuit of team activities and goals likely constitute another facet of immersion in gaming. Highly competitive team games, which demand high focus and large amounts of time spent on practice, may prompt flow states in players (Csikszentmihalyi, 1988). To the extent that any of these other forms of immersion draw people's attention away from attempts at health communication, they could suppress counter-arguing and function much in the same way as the thought disruption mechanism. However, slow paced games, like role-playing games, make full processing of embedded information more likely, and consequently suppression of counter-arguing difficult. Games with a social dimension and entertaining story might alternatively

function as a positive environment which might then be associated with embedded health communications. Any alternate mechanisms of persuasion are important areas of future research.

Finally, research should determine the limits of this medium for delivering complex messaging or messages that introduce new or unfamiliar concepts. In these initial model tests, I delivered messages that were visually attention grabbing and that reminded gamers of a health threat that was already familiar to them. Indeed, debriefing interviews with participants in Study 1 revealed that the images I chose were immediately recognizable to participants, as most or all had seen anti-DUI graphic messaging in the past. It is less clear that I could have introduced a new concern, such as the benefits of getting vaccinated against HPV. Even for messages familiar to these participants, there are likely to be limits to the message complexity I could have pursued. For instance, one strategy for lowering problem drinking in colleges is to alter social norm perceptions (Perkins, 2014). Researchers have found many visually engaging graphic displays that can convey the concept of norm misperception and the errors of logic that might promote problem drinking on colleges. As creative as the visual design of many of these messages are, they require time to process and understand as, by design, they are meant to challenge common assumptions. I have doubts that gamers could have taken the time to make sense of social norming posters if their first time encountering them was in the course of a virtual shoot-out with alien invaders. Even if they did, I believe that immersion into the game might have disrupted the deliberate processes by which social norming can redirect behavior. These problems would likely magnify if the campaign moved from graphic presentation to text presentation of material.

A potential way to get around the issue of complexity will be to treat my games as the “booster session” of other, more elaborate interventions. Given an intervention based on social norming, although it seems unlikely that someone would be able to process such messages

during fast-action game-play, they might be able to *recognize* such campaign materials after being exposed to them. Thus, a researcher who conducts an in-depth, focus-group intervention focused on norm confrontation (e.g., Schroder & Prentice, 1998), might in the process expose participants to norming posters. Later as a take-home gift, the researcher could provide students with games to play that again show these images. Repeated play by the participants in the study will make relevant norming information more accessible in everyday working memory, which should increase the likelihood that the intervention material will influence later behavior (Fazio, 1989; Sanbonmatsu & Fazio, 1991).

Conclusion

Clearly, there is much to learn about both the promise and the limitations of social and health marketing in virtual gaming environments. Future research will need to better assess how the qualities of a game might interact with features of a message and different aspects of a behavior to alter the link between psychological immersion and persuasion. However, the current studies suggest reasons to begin looking for such answers.

Figure 1

Figure 1. Screenshot of DUI poster embedded in first-person shooter game

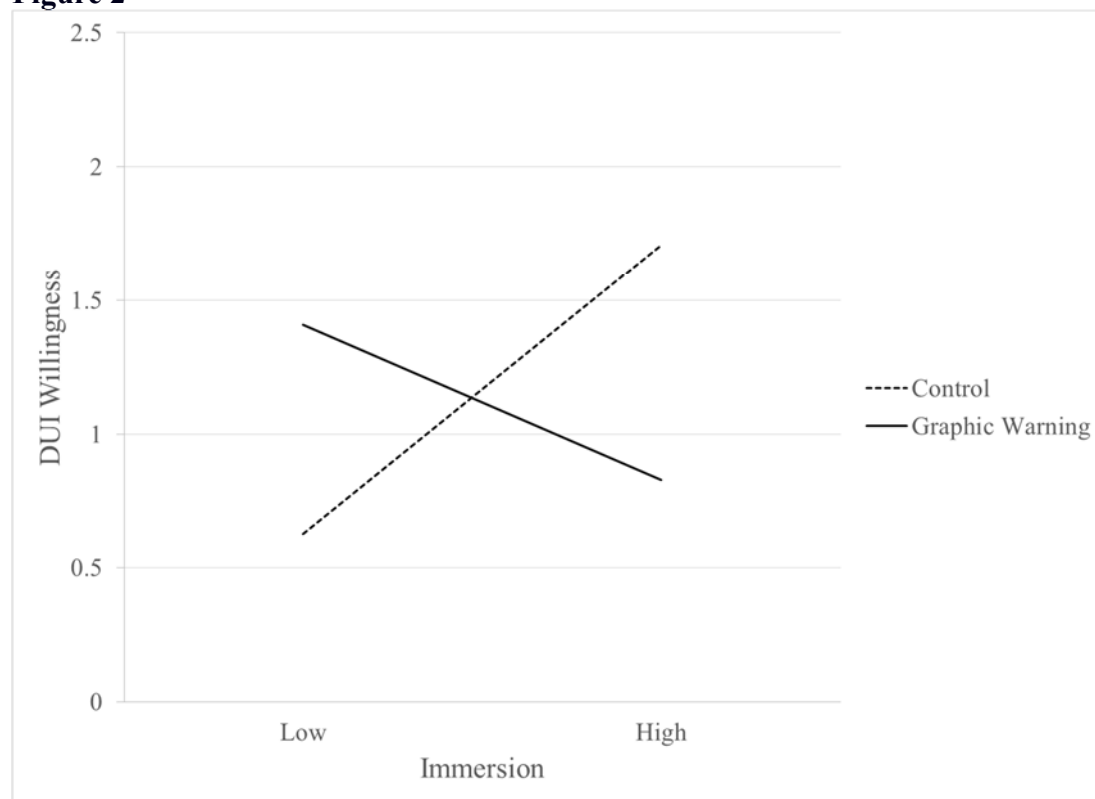
Figure 2

Figure 2. Study 1 willingness to drive under the influence of alcohol one standard of deviation above and below the mean for psychological immersion for participants who were exposed to virtual graphic warnings or who were placed in a no-message control condition. Willingness metric ranges from 0 (extremely unwilling) to 10 (extremely willing).

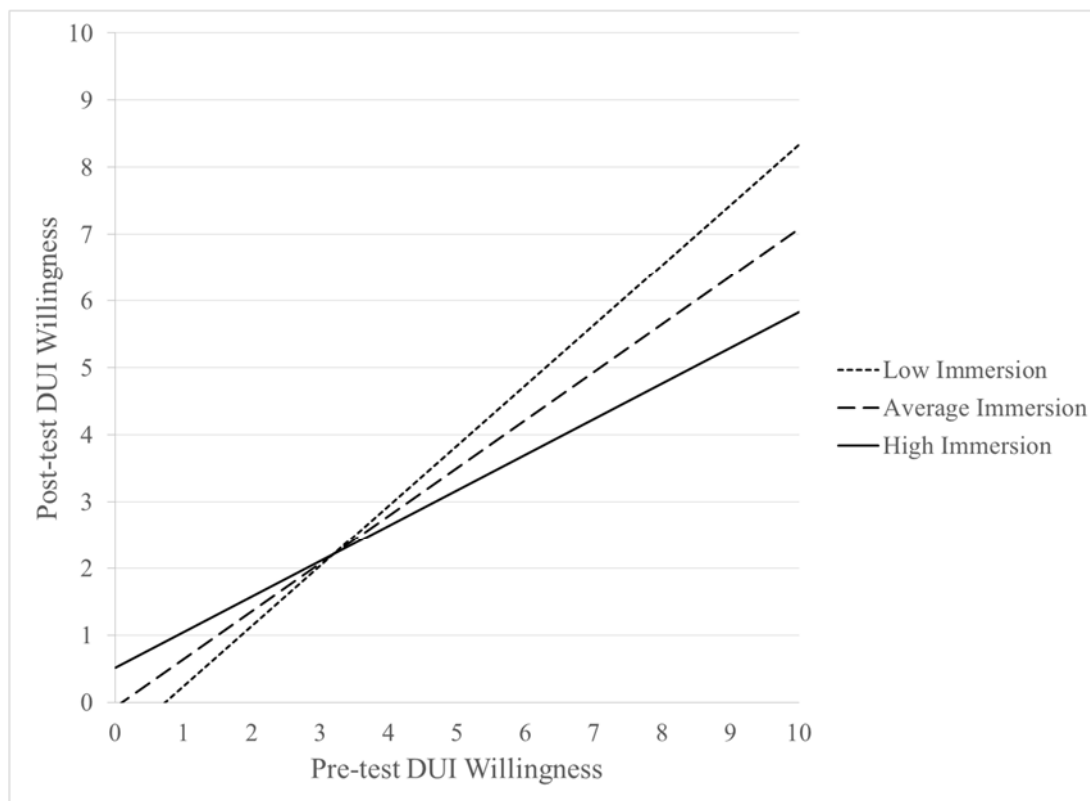
Figure 3

Figure 3. Study 2 willingness to DUI following exposure to virtual graphic warning labels, as a function of pre-exposure DUI attitude. Pre-exposure DUI was scored from 0 to 10 ($M = 2.98$, $SD = 2.21$; Range = 0 to 8.75). DUI willingness was also scored from 0 to 10 ($M = 1.81$, $SD = 1.83$; Range = 0 to 6.94).

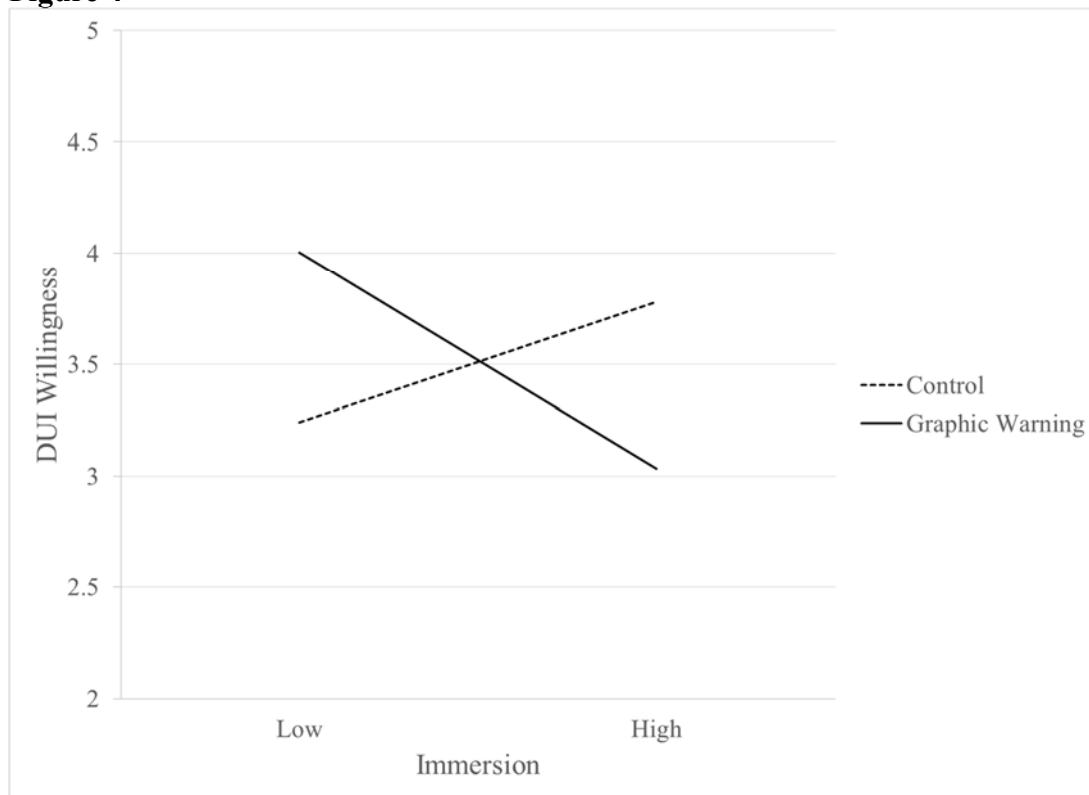
Figure 4

Figure 4. Study 3 willingness to drive under the influence of alcohol, one standard of deviation above and below the mean for psychological immersion for participants who were exposed to virtual graphic warnings or who were placed in a no-message control condition. Willingness metric ranges from 0 (extremely unwilling) to 10 (extremely willing).

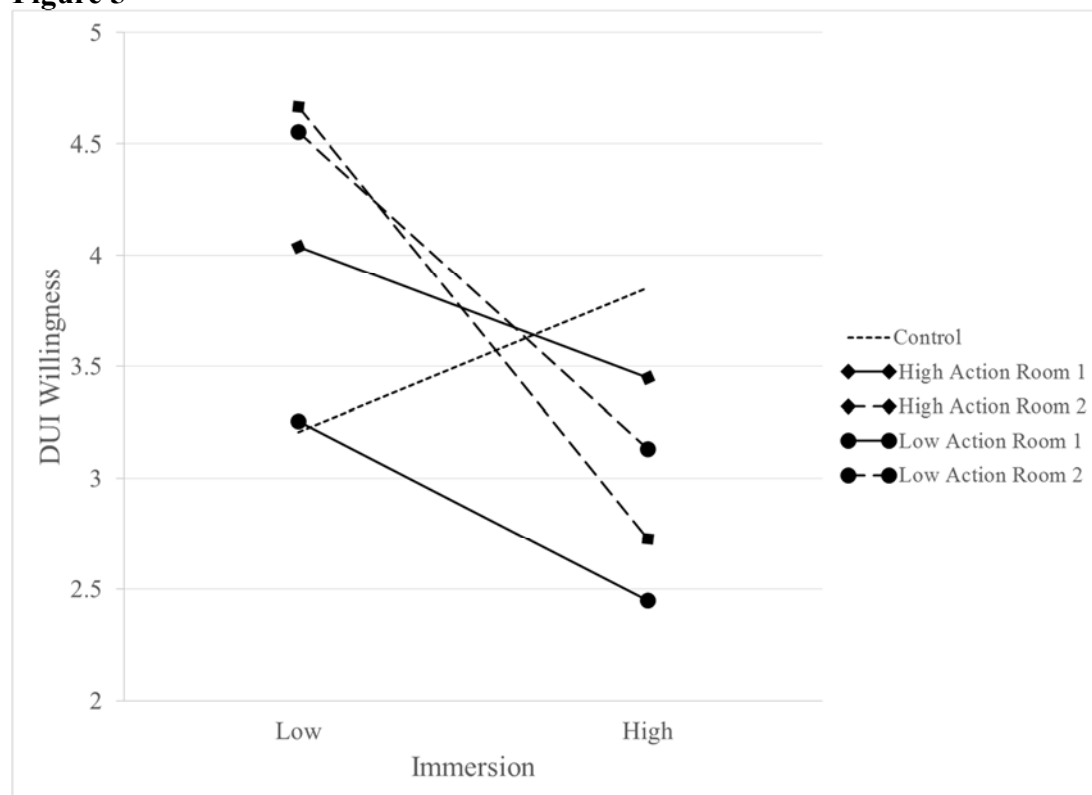
Figure 5

Figure 5. Study 3 willingness to drive under the influence of alcohol one standard of deviation above and below the mean for psychological immersion for participants in each of five possible experimental conditions. Willingness metric ranges from 0 (extremely unwilling) to 10 (extremely willing).

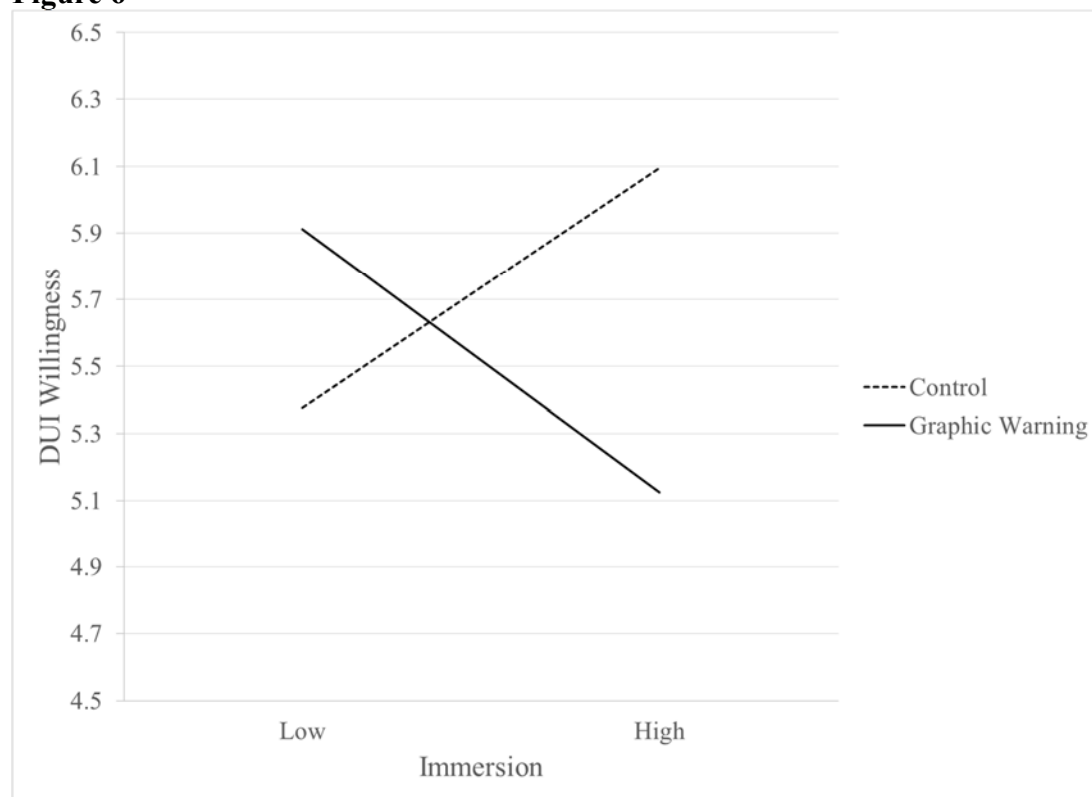
Figure 6

Figure 6. Study 3 willingness to drive under the influence of alcohol one standard of deviation above and below the mean for psychological immersion for participants who were exposed to virtual graphic warnings or who were placed in a no-message control condition. Willingness metric ranges from 0 (extremely unwilling) to 10 (extremely willing).

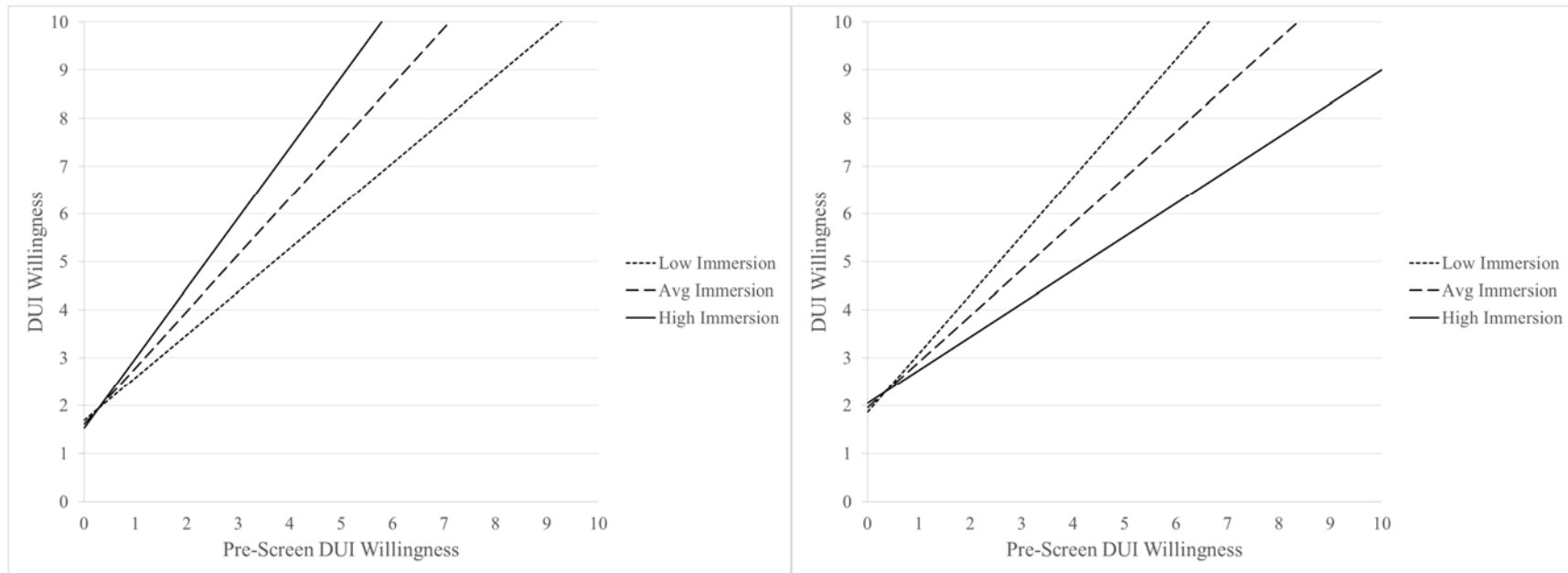
Figure 7

Figure 7. Study 3 willingness to DUI following exposure to virtual graphic warning labels, as a function of experimental condition, pre-exposure DUI willingness, and psychological immersion, and controlling for prior liking of violent videogames. Pre-exposure was both re-scored on to a metric that could range from 0 to 10 ($M = 2.79$, $SD = 1.77$; Range = 0 to 7), as was post-exposure willingness ($M = 2.06$, $SD = 1.51$; Range = 0 to 6.42). The interaction between pre-exposure willingness and psychological immersion was statistically significant among those exposed to anti-DUI graphic warnings, $t(112) = 2.09$, $p = 0.04$, but not in the no-message control condition, $t(112) = 1.25$, $p = 0.22$.

Figure 8

Figure 8. Screenshot taken from Study 4 of an anti-smoking poster embedded in the racing game.

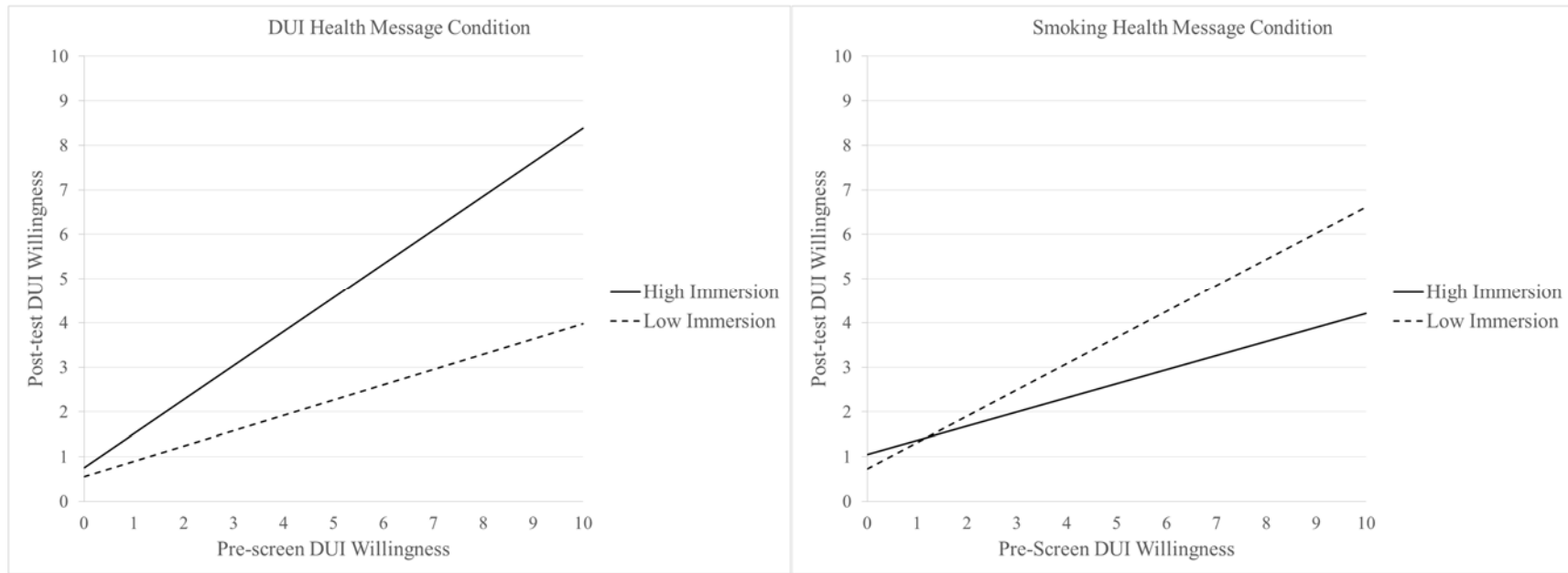
Figure 9

Figure 9. Study 4 willingness to DUI following exposure to virtual graphic warning labels, as a function of experimental condition, pre-screen DUI willingness, and psychological immersion. Pre-screen was both re-scored on to a metric that could range from 0 to 10 ($M = 1.37$, $SD = 1.74$; Range = 0 to 10), as was post-test willingness ($M = 1.41$, $SD = 1.59$; Range = 0 to 6.21).

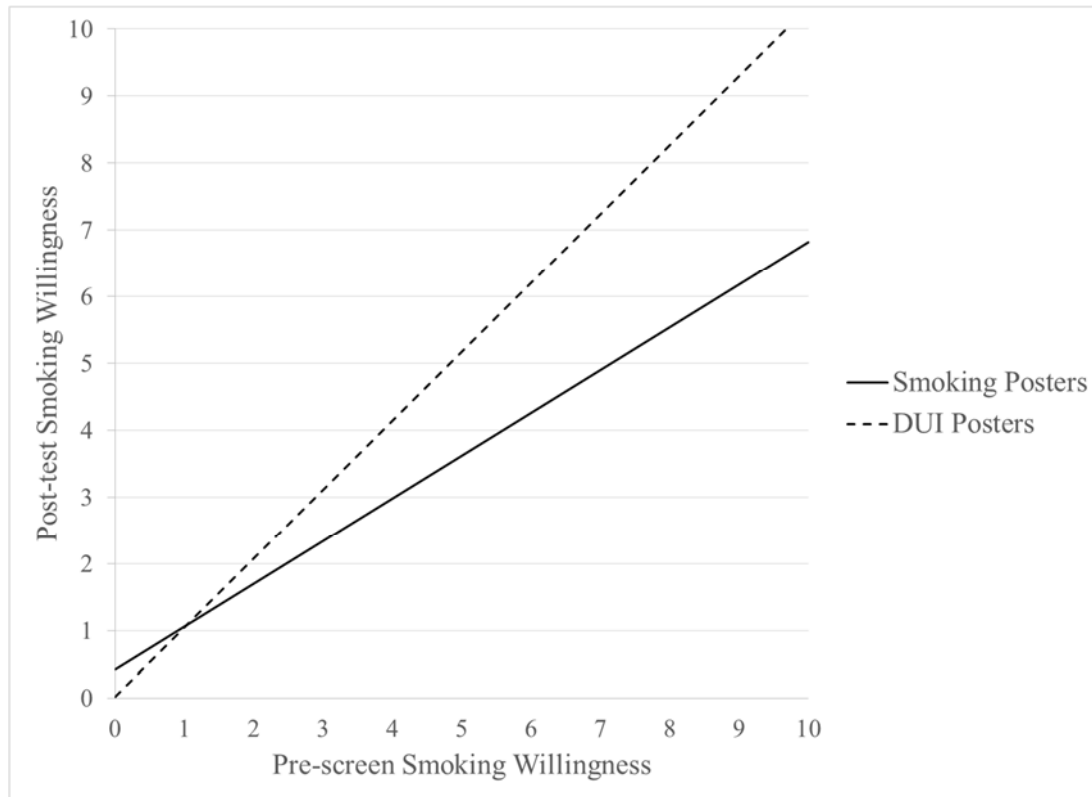
Figure 10

Figure 10. Study 4 willingness to smoke following exposure to virtual graphic warning labels, as a function of experimental condition, pre-screen smoking willingness, and controlling for psychological immersion. Pre-screen was re-scored on to a metric that could range from 0 to 10 ($M = 1.55$, $SD = 1.49$; Range = 0 to 9.25), as was post-test willingness ($M = 1.61$, $SD = 1.98$; Range = 0 to 8.12).

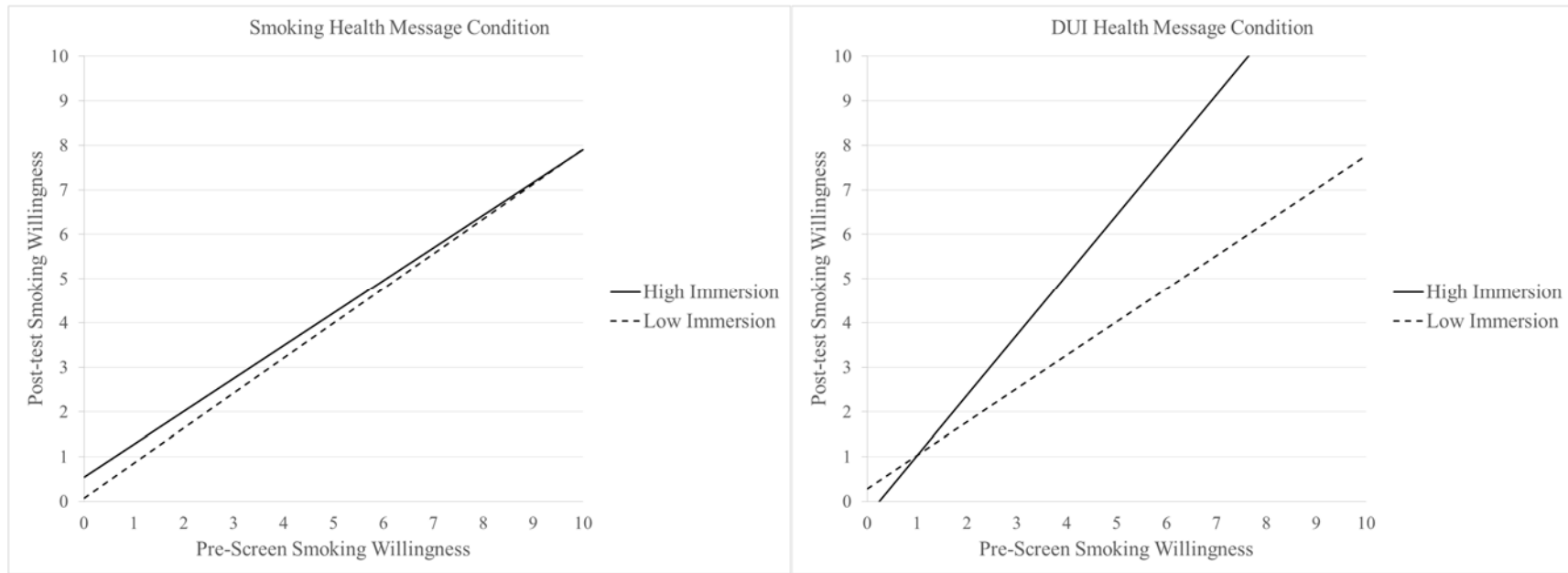
Figure 11

Figure 11. Study 4 willingness to smoke following exposure to virtual graphic warning labels, as a function of experimental condition, pre-screen smoking willingness, and psychological immersion.

Table 1

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>			<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	.89	.46		1.94	.06	-.02	1.80	-0.02	0.17	0.85
	<i>C</i>	-.03	.34	-.01	-.08	.94	-.70	.65			
	<i>I</i>	.10	.17	.07	.58	.56	-.24	.44			
Block 2	<i>Constant</i>	-.13	.60		-.22	.83	-1.32	1.06	0.05	6.50	0.01
	<i>C</i>	1.95	.84	.65	2.32	.02	.27	3.62			
	<i>I</i>	.55	.24	.37	2.27	.03	.07	1.04			
	<i>C X I</i>	-.85	.33	-.80	-2.55	.01	-1.51	-.19			

Table 1. Regression of DUI willingness onto Immersion (I), and Health Message Condition (C) in Study 1.

Table 2

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>			<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	-.17	.70		-.25	.81	-1.55	1.21	0.55	49.35	0.00
	<i>P</i>	.73	.07	.75	9.94	.00	.58	.87			
	<i>I</i>	.02	.23	.01	.096	.92	-.43	.48			
Block 2	<i>Constant</i>	-2.04	1.04		-1.96	.05	-4.11	.03	0.58	5.59	0.02
	<i>P</i>	1.33	.27	1.37	5.03	.00	.80	1.86			
	<i>I</i>	.72	.37	.24	1.96	.05	-.01	1.46			
	<i>P X I</i>	-.23	.10	-.68	-2.36	.02	-.42	-.04			

Table 2. Regression of post-test DUI willingness onto pre-test DUI willingness (P), and Immersion (I) in Study 2.

Table 3

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>			<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	3.89	.57		6.88	.00	2.78	4.99	0.00	1.07	0.36
	<i>E</i>	.042	.06	.04	.74	.46	-.07	.15			
	<i>C</i>	-.00	.29	.00	-.01	.99	-.56	.56			
	<i>I</i>	-.15	.11	-.08	-1.37	.17	-.37	.07			
Block 2	<i>Constant</i>	2.63	.73		3.59	.00	1.19	2.63	0.02	7.12	0.01
	<i>E</i>	.03	.06	.03	.54	.59	-.08	.03			
	<i>C</i>	2.13	.84	.39	2.52	.01	.47	2.13			
	<i>I</i>	.21	.17	.10	1.20	.23	-.13	.21			
	<i>C X I</i>	-.58	.22	-.45	-2.68	.01	-1.01	-.58			

Table 3. Regression of post-test DUI willingness onto Enjoyment of Action Videogames (E), Condition (C), and Immersion (I) in Study 3.

Table 4

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>			<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	3.89	.57		6.86	.00	2.77	5.00	0.00	1.26	0.28
	<i>E</i>	.06	.07	.06	.89	.37	-.07	.19			
	<i>H1</i>	.16	.48	.02	.33	.74	-.79	1.10			
	<i>H2</i>	.40	.42	.06	.95	.34	-.43	1.24			
	<i>L1</i>	-.56	.42	-.08	-1.31	.19	-1.39	.28			
	<i>L2</i>	.02	.41	.00	.04	.97	-.80	.83			
	<i>I</i>	-.17	.11	-.08	-1.49	.14	-.39	.05			
Block 2	<i>Constant</i>	2.29	.75		3.05	.00	.82	3.76	0.03	3.09	0.02
	<i>E</i>	.078	.07	.07	1.17	.24	-.05	.21			
	<i>H1</i>	1.95	1.46	.23	1.34	.18	-.92	4.81			
	<i>H2</i>	3.80	1.18	.54	3.22	.00	1.47	6.12			
	<i>L1</i>	1.36	1.18	.20	1.16	.25	-.96	3.68			
	<i>L2</i>	3.22	1.45	.48	2.23	.03	.38	6.06			
	<i>I</i>	.25	.17	.12	1.46	.15	-.09	.59			
	<i>H1 X I</i>	-.48	.35	-.24	-1.37	.17	-1.17	.21			
	<i>H2 X I</i>	-1.00	.33	-.50	-3.04	.00	-1.65	-.35			
	<i>L1 X I</i>	-.56	.35	-.27	-1.60	.11	-1.25	.13			
	<i>L2 X I</i>	-.80	.33	-.53	-2.41	.02	-1.46	-.15			

Table 4. Regression of post-test DUI willingness onto Enjoyment of Action Videogames (E), High Action Layout One (H1), High Action Layout Two (H2), Low Action Layout One (L1), Low Action Layout Two (L2), and Immersion (I) in Study 3.

Table 5

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>				<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	2.22	.720		3.09	.00	.80	3.64	0.36	27.03	0.00
	<i>P</i>	1.07	.105	.607	10.23	.00	.86	1.28			
	<i>E</i>	-.02	.071	-.015	-.26	.80	-.16	.12			
	<i>C</i>	.03	.333	.004	.08	.94	-.63	.68			
	<i>I</i>	-.10	.135	-.044	-.74	.46	-.37	.17			
Block 2	<i>Constant</i>	1.01	.92		1.10	.27	-.80	2.83	0.37	4.36	0.04
	<i>P</i>	1.07	.10	.61	10.30	.00	.86	1.27			
	<i>E</i>	-.02	.07	-.02	-.33	.74	-.16	.12			
	<i>C</i>	1.91	.96	.34	1.99	.05	.01	3.81			
	<i>I</i>	.28	.23	.12	1.24	.22	-.17	.73			
	<i>P X I</i>	-.59	.28	-.39	-2.09	.04	-1.14	-.03			

Table 5. Regression of post-test DUI willingness onto pre-test DUI willingness (P), Enjoyment of Action Videogames (E), Condition (C), and Immersion (I) in Study 3.

Table 6

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>				<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	2.22	0.72		3.09	0.00	0.80	3.64	0.36	27.03	0.00
	<i>P</i>	1.07	0.11	0.61	10.23	0.00	0.86	1.28			
	<i>E</i>	-0.02	0.07	-0.02	-0.26	0.80	-0.16	0.12			
	<i>C</i>	0.03	0.33	0.00	0.08	0.94	-0.63	0.68			
	<i>I</i>	-0.10	0.14	-0.04	-0.74	0.46	-0.37	0.17			
Block 2	<i>Constant</i>	0.44	1.08		0.41	0.68	-1.70	2.58	0.37	1.80	0.15
	<i>P</i>	1.39	0.35	0.79	3.92	0.00	0.69	2.09			
	<i>E</i>	-0.02	0.07	-0.01	-0.24	0.81	-0.16	0.12			
	<i>C</i>	2.22	1.06	0.39	2.09	0.04	0.12	4.31			
	<i>I</i>	0.39	0.27	0.17	1.45	0.15	-0.14	0.91			
	<i>P X I</i>	-0.07	0.10	-0.13	-0.69	0.49	-0.25	0.12			
	<i>C X I</i>	-0.59	0.28	-0.39	-2.08	0.04	-1.15	-0.03			
	<i>C X P</i>	-0.18	0.22	-0.10	-0.82	0.41	-0.62	0.26			
Block 3	<i>Constant</i>	1.89	1.23		1.54	0.13	-0.53	4.30	0.39	5.81	0.02
	<i>P</i>	0.40	0.54	0.23	0.73	0.47	-0.67	1.46			
	<i>E</i>	-0.01	0.07	-0.01	-0.13	0.89	-0.15	0.13			
	<i>C</i>	-0.14	1.43	-0.02	-0.10	0.92	-2.96	2.69			
	<i>I</i>	-0.07	0.32	-0.03	-0.21	0.83	-0.71	0.57			
	<i>P X I</i>	0.25	0.16	0.47	1.54	0.13	-0.07	0.56			
	<i>C X I</i>	0.15	0.41	0.10	0.36	0.72	-0.67	0.97			
	<i>C X P</i>	1.30	0.65	0.72	1.99	0.05	0.01	2.59			
	<i>P X I X C</i>	-0.48	0.20	-0.85	-2.41	0.02	-0.87	-0.09			

Table 6. Regression of post-test DUI willingness onto pre-test DUI willingness (P), Enjoyment of Action Videogames (E), Condition (C), and Immersion (I) in Study 3.

Table 7

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>			<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	0.40	0.40		0.98	0.33	-0.40	1.20	.27	18.28	0.00
	<i>P</i>	0.47	0.07	0.51	7.14	0.00	0.34	0.60			
	<i>I</i>	0.15	0.13	0.08	1.15	0.25	-0.11	0.41			
	<i>C</i>	-0.04	0.23	-0.01	-0.18	0.85	-0.50	0.42			
Block 2	<i>Constant</i>	1.19	0.67		1.77	0.08	-0.14	2.52	.28	1.83	0.15
	<i>P</i>	0.41	0.24	0.45	1.73	0.09	-0.06	0.88			
	<i>I</i>	-0.09	0.24	-0.05	-0.40	0.69	-0.56	0.37			
	<i>C</i>	-1.55	0.76	-0.48	-2.05	0.04	-3.05	-0.05			
	<i>C X I</i>	0.48	0.27	0.44	1.81	0.07	-0.05	1.01			
	<i>P X I</i>	-0.01	0.07	-0.02	-0.10	0.92	-0.15	0.13			
	<i>P X C</i>	0.16	0.14	0.14	1.14	0.26	-0.11	0.43			
Block 3	<i>Constant</i>	0.42	0.71		0.59	0.56	-0.99	1.83	.31	7.51	.01
	<i>P</i>	0.86	0.28	0.93	3.02	0.00	0.30	1.42			
	<i>I</i>	0.18	0.25	0.10	0.71	0.48	-0.32	0.68			
	<i>C</i>	-0.05	0.92	-0.02	-0.06	0.96	-1.87	1.77			
	<i>C X I</i>	-0.07	0.33	-0.06	-0.21	0.83	-0.72	0.58			
	<i>P X I</i>	-0.15	0.09	-0.52	-1.76	0.08	-0.33	0.02			
	<i>P X C</i>	-0.93	0.42	-0.85	-2.22	0.03	-1.76	-0.10			
	<i>P X I X C</i>	0.39	0.14	0.99	2.74	0.01	0.11	0.67			

Table 7. Study 4 Regression Showing the Three-way Interaction of DUI Willingness on Pre-screen DUI Willingness (P), Immersion (I), and Health Message Condition (C)

Table 8

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>95% Confidence Interval</i>		<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>				<i>Lower</i>	<i>Upper</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	-0.27	0.38		-0.71	0.48	-1.01	0.48	.52	53.38	.00
	<i>P</i>	0.94	0.08	0.71	12.17	0.00	0.78	1.09			
	<i>I</i>	0.17	0.13	0.08	1.29	0.20	-0.09	0.43			
	<i>C</i>	-0.14	0.23	-0.04	-0.62	0.54	-0.61	0.32			
Block 2	<i>Constant</i>	-0.06	0.58		-0.10	0.92	-1.20	1.08	.53	1.75	.16
	<i>P</i>	0.74	0.21	0.56	3.47	0.00	0.32	1.17			
	<i>I</i>	0.03	0.21	0.01	0.13	0.89	-0.39	0.45			
	<i>C</i>	0.53	0.76	0.13	0.70	0.49	-0.98	2.05			
	<i>C X I</i>	-0.05	0.27	-0.03	-0.17	0.86	-0.58	0.49			
	<i>P X I</i>	0.11	0.08	0.29	1.46	0.15	-0.04	0.26			
	<i>P X C</i>	-0.39	0.18	-0.22	-2.15	0.03	-0.75	-0.03			
Block 3	<i>Constant</i>	0.86	0.68		1.26	0.21	-0.49	2.22	.55	5.73	.02
	<i>P</i>	0.15	0.32	0.12	0.48	0.63	-0.49	0.80			
	<i>I</i>	-0.34	0.26	-0.15	-1.31	0.19	-0.85	0.17			
	<i>C</i>	-1.27	1.06	-0.32	-1.19	0.24	-3.37	0.84			
	<i>C X I</i>	0.61	0.38	0.45	1.59	0.11	-0.15	1.36			
	<i>P X I</i>	0.34	0.12	0.88	2.80	0.01	0.10	0.58			
	<i>P X C</i>	0.68	0.48	0.38	1.41	0.16	-0.27	1.62			
	<i>P X I X C</i>	-0.37	0.15	-0.80	-2.39	0.02	-0.67	-0.06			

Table 8. Study 4 Regression Showing the Three-way Interaction of Smoking Willingness on Pre-screen DUI Willingness (P), Immersion (I), and Health Message Condition (C)

References

- Agostinelli, G., & Grube, J. W. (2002). Alcohol counter-advertising and the media: A review of recent research. *Alcohol Research and Health*, 26(1), 15-21.
- Anderson, C. A., & Bushman, B. J. (2002). The effects of media violence on society. *Science*, 295, 2377-2378.
- Anderson, C. A., & Dill, K. E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *Journal of Personality and Social Psychology*, 78(4), 772-790.
- Andrews, J. A., Gordon, J. S., Hampson, S. E., Christiansen, S. M., Gunn, B., Slovic, P., & Severson, H. H. (2011). Short-term efficacy of Click City®: Tobacco: Changing etiological mechanisms related to the onset of tobacco use. *Prevention Science*, 12(1), 89-102.
- Azagba, S., & Sharaf, M. F. (2013). The effect of graphic cigarette warning labels on smoking behavior: Evidence from the Canadian experience. *Nicotine & Tobacco Research*, 15(3), 708-717.
- Baranowski, T., Buday, R., Thompson, D. I., & Baranowski, J. (2008). Playing for real: Video games and stories for health-related behavior change. *American Journal of Preventive Medicine*, 34(1), 74-82.
- Baron, R. S., Baron, P. H., & Miller, N. (1973). The relation between distraction and persuasion. *Psychological Bulletin*, 80(4), 310-323.
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.

- Bartholow, B. D., & Heinz, A. (2006). Alcohol and aggression without consumption: Alcohol cues, aggressive thoughts, and hostile perception bias. *Psychological Science*, 17, 30–37.
- Blanton, H., Snyder, L. B., Strauts, E., & Larson, J. G. (2014). Effect of graphic cigarette warnings on smoking intentions in young adults. *Plos ONE*, 9(5).
- Blumberg, F. C., Almonte, D. E., Anthony, J. S., & Hashimoto, N. (2013). Serious games: What are they? What do they do? Why should we play them? In K. E. Dill, K. E. Dill (Eds.), *The Oxford Handbook of Media Psychology* (pp. 334-351). New York, NY, US: Oxford University Press.
- Borland, R. R., Wilson, N. N., Fong, G. T., Hammond, D. D., Cummings, K. M., Yong, H. H., & McNeill, A. A. (2009). Impact of graphic and text warnings on cigarette packs: Findings from four countries over five years. *Tobacco Control: An International Journal*, 18(5), 358-364.
- Brusse, E.D.A., Neijens, P.C., & Smit, E.G. (2010. Talking to deaf ears? Two routes to narrative persuasion in entertainment education", *International Conference on Future Imperatives of Communication and Information for Development and Social Change, Bangkok*. Retrieved on 10/5/2014 at: <http://203.131.210.100/conference/wp-content/uploads/2011/06/12-01-Asbeek-Neijens-Smit-Talking-to-deaf-ears.pdf>
- Bushman, Brad J., & Pollard-Sacks, D. (2014). Supreme Court decision on violent video games was based on the First Amendment, not scientific evidence. *American Psychologist*, 69(3), 306-307.
- Chang, F., Chung, C., Yu, P., & Chao, K. (2011). The impact of graphic cigarette warning labels and smoke-free law on health awareness and thoughts of quitting in Taiwan. *Health Education Research*, 26(2), 179-191.

- Christensen, J. L., Miller, L. C., Appleby, P. R., Corsbie-Massay, C., Godoy, C. G., Marsella, S. C., & Read, S. J. (2013). Reducing shame in a game that predicts HIV risk reduction for young adult men who have sex with men: a randomized trial delivered nationally over the web. *Journal of the International AIDS Society*, 161-8.
- Csikszentmihalyi, M. (1988). The flow experience and its significant for human psychology. In M. Csikszentmihalyi & I.S. Csikszentmihalyi (Eds.), *Optimal Experience: Psychological studies of flow in consciousness* (pp. 15 - 35). New York: Cambridge University Press.
- Culbertson, C. S., Shulenberger, S., De La Garza, R., Newton, T. F., & Brody, A. L. (2012). Virtual reality cue exposure therapy for the treatment of tobacco dependence. *Journal of Cybertherapy And Rehabilitation*, 5(1), 57-64.
- DeSmet, A., Van Ryckeghem, D., Compernelle, S., Baranowski, T., Thompson, D., Crombez, G., Poels, K., Van Lippevelde, W., Bastiaensens, S., Van Cleemput, K., Vandebosch, H., & De Bourdeaudhuij, I. (2014). A Meta-Analysis of Serious Digital Games for Healthy Lifestyle Promotion. *Preventive Medicine*, 69, 95-107.
- Dijkstra, M. M., Mesters, I. I., De Vries, H. H., van Breukelen, G. G., & Parcel, G. S. (1999). Effectiveness of a social influence approach and boosters to smoking prevention. *Health Education Research*, 14(6), 791-802.
- Dill, K. E., Brown, B. P., & Collins, M. A. (2008). Effects of exposure to sex-stereotyped video game characters on tolerance of sexual harassment. *Journal of Experimental Social Psychology*, 44(5), 1402-1408.
- Downs, J.S., Murray, P.J., Bruine de Bruin, W., Penrose, J., Palmgren, C., & Fischhoff, B. (2004). Interactive video behavioral intervention to reduce adolescent females STD risk: A randomized controlled trial. *Social Science and Medicine*, 59(8), 1561 - 1572.

- Durkin, S., Brennan, E., & Wakefield, M. (2012). Mass media campaigns to promote smoking cessation among adults: An integrative review. *Tobacco Control: An International Journal*, 21(2), 127-138.
- Eastin, M. S. (2006). Videogame violence and the female game player- self- and opponent gender effects on presence and aggressive thoughts. *Communication Research*, 33(6), 448-466.
- Entertainment Software Association (2014). *Essential Facts About the Computer and Video Game Industry: Sales, Demographic, and Usage Data*. Retrieved September, 2014 from http://www.theesa.com/facts/pdfs/esa_ef_2014.pdf.
- Fazio, R. H. (1989). On the power and functionality of attitudes: The role of attitude accessibility. In A. R. Pratkanis, S. J. Breckler, A. G. Greenwald (Eds.), *Attitude structure and function* (pp.153-179). Hillsdale, N.J.: Erlbaum.
- Fazio, R. H., & Towles-Schwen, T. (1999). The MODE model of attitude-behavior processes. In S. Chaiken, Y. Trope (Eds.), *Dual-process Theories in Social Psychology* (pp. 97-116). New York, NY, US: Guilford Press.
- Ferguson, C. J. (2007). Evidence for publication bias in video game violence effects literature: A meta-analytic review. *Aggression and Violent Behavior*, 12, 470-482.
- Ferguson, C. J. (2009). Media violence effects: Confirmed truth or just another X-File? *Journal of Forensic Psychology Practice*, 9(2), 103-126.
- Ferrer-García, M., García-Rodríguez, O., Gutiérrez-Maldonado, J., Pericot-Valverde, I., & Secades-Villa, R. (2010). Efficacy of virtual reality in triggering the craving to smoke: Its relation to level of presence and nicotine dependence. *Annual Review of Cybertherapy and Telemedicine*, 8, 99-102.

- Gerrard, M., Gibbons, F.X., Houlihan, A.E., Stock, M.L., & Pomery, E.A. (2008). A dual-process approach to health risk decision making: The prototype willingness model. *Developmental Review, 28*, 29 – 61.
- Gerrig, R.J., & Prentice, D.A. (1996). The representation of fictional information. *Psychological Science, 2*, 336 – 340.
- Gibbons, F. X., Gerrard, M., Blanton, H., & Russell, D. W. (1998). Reasoned action and social reaction: Willingness and intention as independent predictors of health risk. *Journal of Personality and Social Psychology, 74*(5), 1164-1180.
- Gilbert, D. T. (1991). How mental systems believe. *American Psychologist, 46*(2), 107–199.
- Girard, B., Turcotte, V., Bouchard, S., & Girard, B. (2009). Crushing virtual cigarettes reduces tobacco addiction and treatment discontinuation. *Cyber Psychology and Behavior, 12*, 477 – 483.
- Granic, I., Lobel, A., & Engels, R.C.M.E. (2014). The benefits of playing videogames. *American Psychologist, 69*(1), 66-78.
- Green, M. C., & Brock, T. C. (2000). The role of transportation in the persuasiveness of public narratives. *Journal of Personality and Social Psychology, 79*(5), 701-721.
- Green, M. C., & Clark, J. L. (2013). Transportation into narrative worlds: Implications for entertainment media influences on tobacco use. *Addiction, 108*(3), 477-484.
- Hull, J.G., Brunelle, T.J., & Prescott, A.T. (2014). A longitudinal study of risk-glorifying videogames and behavioral deviance. *Journal of Personality and Social Psychology, 107*(2), 300 – 325.
- Hull, J. G., Draghici, A. M., & Sargent, J. D. (2012). A longitudinal study of risk-glorifying videogames and reckless driving. *Psychology of Popular Media Culture, 1*(4), 244-253.

- Iyer, P., Korin, M. R., Higginbotham, L., & Davidson, K. W. (2010). Anger, anger expression, and health. In J. M. Suls, K. W. Davidson, R. M. Kaplan, J. M. Suls, K. W. Davidson, R. M. Kaplan (Eds.), *Handbook of Health Psychology and Behavioral Medicine* (pp. 120-132). New York, NY, US: Guilford Press.
- Jeong, E., Bohil, C. J., & Biocca, F. A. (2011). Brand logo placements in violent games: Effects of violence cues on memory and attitude through arousal and presence. *Journal of Advertising*, 40(3), 59-72.
- Kreuter, M.W., Green, M.C., Cappella, J.N., Slater, M.D., Wise, M.E., Storey, D., Clark, E.M., O'Keefe, D.J., Erwin, D.O., Holmes, K., Hinyard, L.J., Houston, T., & Woolley, S. (2007). Narrative communication in cancer prevention and control: A framework to guide research and application. *Annals of Behavioral Medicine*, 33(3), 221-235.
- Kreuter, M. W., Holmes, K., Alcaraz, K., Kalesan, B., Rath, S., Richert, M., & Clark, E. M. (2010). Comparing narrative and informational videos to increase mammography in low-income African American women. *Patient Education and Counseling*, 81(Suppl 1), S6-S14.
- Leavy, J. E., Bull, F. C., Rosenberg, M., & Bauman, A. (2011). Physical activity mass media campaigns and their evaluation: A systematic review of the literature 2003–2010. *Health Education Research*, 26(6), 1060-1085.
- Lenhart, A., Jones, S., & Macgill, A. (2008). Adults and Video Games. *The Pew Internet & American Life Project*. Retrieved at: <http://www.pewinternet.org/2008/12/07/adults-and-video-games/> in August, 2015.

- Leventhal, H. (1970). Findings and theory in the study of fear communications. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 5, pp. 119-186). Sand Diego, CA: Academic Press.
- Marsh, E. J., & Fazio, L. K. (2006). Learning errors from fiction: Difficulties in reducing reliance on fictional stories. *Memory & Cognition*, 34(5), 1140-1149.
- Marsh, E. J., Meade, M. L., & Roediger, H. (2003). Learning facts from fiction. *Journal Of Memory And Language*, 49(4), 519-536.
- Minsky, M. (1980, June). Telepresence. *Omni*, pp. 45–51.
- Neimeyer, G. J., MacNair, R., Metzler, A. E., & Courchaine, K. (1991). Changing personal beliefs: Effects of forewarning, argument quality, prior bias, and personal exploration. *Journal of Social and Clinical Psychology*, 10(1), 1-20.
- Nelson, M. R., & Waiguny, M. J. (2012). Psychological processing of in-game advertising and advergames: Branded entertainment or entertaining persuasion? In L. J. Shrum (Ed.) , *The psychology of entertainment media: Blurring the lines between entertainment and persuasion*, 2nd ed (pp. 93-144). New York, NY, US: Routledge/Taylor & Francis Group.
- Nelson, M. R., Yaros, R. A., & Keum, H. (2006). Examining the influence of telepresence on spectator and player processing of real and fictitious brands in a computer game. *Journal of Advertising*, 35(4), 87-99.
- NPD Group (2011). *Kids & Gaming: 2011 Report*, 2014 from https://www.npd.com/lps/Kids_Gaming_2011/.
- Pempek T.A., & Calvert S.L. (2009). Tipping the balance: Use of advergames to promote consumption of nutritious foods and beverages by low income African American children. *Archives of Pediatric Adolescent Medicine*, 163, 633 – 637.

- Peng W. (2009). Design and evaluation of a computer game to promote a healthy diet for young adults. *Health Communication*, 24, 115 – 127.
- Perkins, H. W. (2014). Misperception is reality: The reign of error. In Xenitidou, M. and B. Edmonds. (Eds.), *The Complexity of Social Norms* (pp. 11-36). Switzerland: Springer International Publishing.
- Petty, R. E., Wells, G. L., & Brock, T. C. (1976). Distraction can enhance or reduce yielding to propaganda: Thought disruption versus effort justification. *Journal of Personality And Social Psychology*, 34(5), 874-884.
- Prentice, D. A., & Gerrig, R. J. (1999). Exploring the boundary between fiction and reality. In S. Chaiken, Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 529-546). New York, NY, US: Guilford Press.
- Primack, B. A., Carroll, M. V., McNamara, M., Klem, M., King, B., Rich, M., Chan, C.W., & Nayak, S. (2012). Role of videogames in improving health-related outcomes: A systematic review. *American Journal of Preventive Medicine*, 42(6), 630-638.
- Rivis, A., Abraham, C., & Snook, S. (2011). Understanding young and older male drivers' willingness to drive while intoxicated: The predictive utility of constructs specified by the theory of planned behaviour and the prototype willingness model. *British Journal Of Health Psychology*, 16(2), 445-456.
- Rogers, R. W., & Mewborn, C. R. (1976). Fear appeals and attitude change: Effects of a threat's noxiousness, probability of occurrence, and the efficacy of coping responses. *Journal of Personality and Social Psychology*, 34(1), 54-61.

- Ross, L., Rodin, J., & Zimbardo, P. G. (1969). Toward an attribution therapy: The reduction of fear through induced cognitive-emotional misattribution. *Journal of Personality and Social Psychology*, 12(4), 279-288.
- Sanbonmatsu, D. M., & Fazio, R. H. (1991). Construct accessibility: Determinants, consequences, and implications for the media. In J. Bryant, D. Zillmann, J. Bryant, D. Zillmann (Eds.), *Responding to the screen: Reception and reaction processes* (pp. 45-62). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.
- Schneider, L.P., & Cornwell, T.B. (2005). Cashing in on crashes via brand placement in computer games: The effects of experience and flow on memory. *International Journal of Advertising*, 24(3), 321 - 343.
- Schroeder, C. M., & Prentice, D. A. (1998). Exposing pluralistic ignorance to reduce alcohol use among college students. *Journal of Applied Social Psychology*, 28(23), 2150-2180.
- Slater, M., & Usoh, M. (1993). Representations systems, perceptual position, and presence in immersive virtual environments. *Presence*, 2(3), 221-233.
- Stroebe, W., Mensink, W., Aarts, H., Schut, H., & Kruglanski, A. (2008). Why dieters fail: Testing the goal conflict model of eating. *Journal of Experimental Social Psychology*, 44, 26-36.
- Struckman-Johnson, C., Struckman-Johnson, D., Gilliland, R. C., & Ausman, A. (1994). Effect of persuasive appeals in AIDS PSAs and condom commercials on intentions to use condoms. *Journal Of Applied Social Psychology*, 24(24), 2223-2244.
- Tamborini, R., Eastin, M. S., Skalski, P., Lachlan, K., Fediuk, T. A., & Brady, R. (2004). Violent virtual videogames and hostile thoughts. *Journal of Broadcasting and Electronic Media*, 48, 335-357.

- Wheeler, S. C., Green, M. C., & Brock, T. C. (1999). Fictional narratives change beliefs: Replications of Prentice, Gerrig, & Bailis (1997) with mixed corroboration. *Psychonomic Bulletin & Review*, 6(1), 136-141.
- White, V., Webster, B., & Wakefield, M. (2008). Do graphic health warning labels have an impact on adolescents' smoking-related beliefs and behaviours? *Addiction*, 103(9), 1562-1571.
- Williams, J. H., Green, M. C., Kohler, C., Allison, J. J., & Houston, T. K. (2011). Stories to Communicate Risks about Tobacco: Development of a Brief Scale to Measure Transportation into a Video Story--The ACCE Project. *Health Education Journal*, 70(2), 184-191.
- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, 59(4), 329-349.
- Yang, M., Roskos-Ewoldsen, D. R., Dinu, L., & Arpan, L. M. (2006). The Effectiveness of 'In-Game' Advertising: Comparing College Students' Explicit and Implicit Memory for Brand Names. *Journal of Advertising*, 35(4), 143-152.

Appendix A

Study 1 Ancillary Results

T-test for experiment vs control condition on immersion. The effect of experiment condition on immersion was not statistically significant, $t(81) = 0.89$, $p = 0.38$.

Regression for willingness to drink alcohol. I regressed willingness to drink alcohol on experimental condition (control = 0, experimental condition = 1), immersion and their multiplicative cross-product. This revealed no significant predictors, see table below.

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>				<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	.536	.082		6.530	.000	0.02	1.87	0.161
	<i>C</i>	.115	.061	.210	1.895	.062			
	<i>I</i>	-.017	.031	-.059	-.534	.595			
Block 2	<i>Constant</i>	.458	.111		4.142	.000	0.02	1.12	0.294
	<i>C</i>	.266	.156	.488	1.710	.091			
	<i>I</i>	.018	.045	.066	.406	.686			
	<i>C X I</i>	-.065	.062	-.335	-1.056	.294			

Gender, age and ethnicity effects. Women did not differ compared to men on reported willingness to DUI, $t(81) = 1.00$, $p = 0.32$. However, women did have significantly higher immersion scores (Women Mean = 2.97 SD = .95, Men Mean = 2.17 SD = .91), $t(82) = 3.23$, $p < 0.01$, but lower reported willingness to drink alcohol (Women Mean = .44 SD = .27, Men Mean = .59 SD = .27), $t(81) = 2.16$, $p = 0.03$.

Age was significantly correlated with willingness to drink alcohol, $r(83) = .29$, $p < .01$, and with immersion, $r(84) = -.11$, $p = .32$.

Compared to participants of other ethnicities, White participants did not differ significantly on reported willingness to DUI, $t(84) = 1.83, p = 0.07$, or on immersion, $t(82) = 1.77, p = 0.08$. White participants did have significantly lower reported willingness to drink alcohol than non-White participants (White Mean = 2.60 SD = .86, Non-White Mean = 2.21 SD = 1.01), $t(82) = 3.64, p < 0.01$.

Study 2 Ancillary Results

Correlations for willingness to drink alcohol. I regressed willingness to drink alcohol on immersion. The predictor was not significant, see table below.

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>		<i>t</i>	<i>Sig</i>	<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>					<i>Estimate</i>	<i>p-value</i>
<i>Block 1</i>	<i>Constant</i>	5.710	1.287			4.436	.000	-0.01	0.18	0.673
	<i>I</i>	.170	.401	.043		.423	.673			

Gender, age and ethnicity effects. No gender differences were detected for pre-test reported willingness to DUI, $t(80) = 1.71, p = 0.09$, post-test reported willingness to DUI, $t(78) = 1.27, p = 0.21$, willingness to drink alcohol, $t(84) = 1.24, p = 0.22$, or reactance, $t(80) = -1.01, p = 0.32$. However, a significant gender difference existed for immersion (Women Mean = 3.26 SD = .96, Men Mean = 2.60 SD = .81), $t(84) = -3.13, p < 0.01$ and in-game reported fear (Women Mean = 2.46 SD = 1.26, Men Mean = 1.75 SD = .79), $t(84) = -3.05, p < 0.01$, such that women were more immersed than men and more likely to report being frightened by the game.

Age was not significantly correlated with pre-test willingness to DUI, $r(82) = .17, p = .12$, post-test willingness to DUI, $r(80) = .15, p = .15$, willingness to drink alcohol, $r(86) = .07, p = .51$, in-game reported fear, $r(86) = .11, p = .30$, reactance, $r(82) = .12, p = .27$, or immersion, $r(86) = .08, p = .45$.

No ethnicity differences were detected for reported pre-test willingness to DUI, $t(82) = .01, p = 0.99$, post-test willingness to DUI, $t(80) = -.28, p = 0.78$, in-game reported fear, $t(97) = 1.07, p = 0.29$, reactance, $t(82) = .28, p = 0.78$, or immersion, $t(85) = 1.22, p = 0.23$. However, significant ethnicity differences existed for willingness to drink alcohol in that White participants reported higher willingness to drink alcohol than participants of other ethnicities (White Mean =

7.61 SD = 3.08, Non-White Mean = 4.99 SD = 3.18), $t(98) = -4.17, p < 0.01$.

Fear. In-game reported fear was significantly and positively related to immersion, $r(87) = .45, p < .01$, but unrelated to pre-test willingness to DUI, $r(83) = -.09, p = .42$, post-test willingness to DUI, $r(81) = -.07, p = .53$, willingness to drink alcohol, $r(99) = .09, p = .37$, or reactance, $r(83) = .20, p = .07$.

Study 3 Ancillary Results

ANOVA for experiment conditions on immersion and prior game enjoyment. A one-way ANOVA was significant, $F(4, 402) = 13.00, p < 0.01$, for immersion grouped by experiment condition (control, high action 1, high action 2, low action 1, and low action 2). Post-hoc comparisons using Tukey HSD test indicated that all experimental conditions were significantly different to the control condition (Mean = 3.68, SD = 1.29) on immersion. High action 1 (Mean = 4.01, SD = 1.35) was significantly lower than the control condition, high action 2 (Mean = 3.24, SD = 1.14) was significantly higher, low action 1 (Mean = 2.99, SD = 1.13) was significantly higher, and low action 2 (Mean = 4.27, SD = 1.14) was significantly lower.

I also found a one-way ANOVA to be significant for prior game enjoyment, $F(4, 372) = 46.03, p < 0.01$, grouped by experiment condition. Post-hoc comparisons using Tukey HSD test indicated that all experimental conditions were significantly different to the control condition (Mean = 4.15, SD = 2.43) on prior game enjoyment. High action 1 (Mean = 2.65, SD = 0.89) was significantly lower than the control condition, high action 2 (Mean = 5.87, SD = 2.32) was significantly higher, low action 1 (Mean = 6.44, SD = 2.35) was significantly higher, and low action 2 (Mean = 2.51, SD = 1.00) was significantly lower.

Regression for willingness to drink alcohol. Regressing willingness to drink alcohol onto prior gaming enjoyment (E), experimental condition (C) and immersion (I), with a multiplicative cross-product of the interaction between condition and immersion. The main effects for prior gaming enjoyment, $B = .31, t(358) = 9.85, p < 0.01$, and immersion, $B = -.24, t(358) = -2.37, p = 0.02$, were statistically significant.

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>		<i>t</i>	<i>Sig</i>	<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>					<i>Estimate</i>	<i>p-value</i>

Block 1	<i>Constant</i>	5.189	.527		9.854	.000	0.12	17.36	0.00
	<i>E</i>	.312	.053	.304	5.908	.000			
	<i>C</i>	-.090	.266	-.017	-.340	.734			
	<i>I</i>	-.244	.103	-.122	-2.374	.018			
Block 2	<i>Constant</i>	5.603	.688		8.145	.000	0.12	0.87	0.35
	<i>E</i>	.316	.053	.308	5.962	.000			
	<i>C</i>	-.789	.794	-.147	-.994	.321			
	<i>I</i>	-.362	.162	-.180	-2.226	.027			
	<i>C X I</i>	.192	.205	.149	.934	.351			

Gender, age and ethnicity effects. No gender differences were detected for pre-test reported willingness to DUI, $t(198) = -1.86, p = 0.07$. However, a significant gender difference existed for post-test reported willingness to DUI, $t(412) = -4.44, p < 0.01$, willingness to drink alcohol, $t(412) = -4.64, p < 0.01$, and immersion, $t(400) = -4.63, p < 0.01$. Women were less willing to DUI than men (Women Mean = 2.84 SD = 1.20, Men Mean = 3.97 SD = 2.76), and women were less willing to drink alcohol than men (Women Mean = 4.86 SD = 2.51, Men Mean = 6.04 SD = 2.56), but women were more immersed than men (Women Mean = 3.98 SD = 1.20, Men Mean = 3.39 SD = 1.29).

Age was not significantly correlated with post-test reported willingness to DUI, $r(410) = -.01, p = .82$, willingness to drink alcohol, $r(417) = -.04, p = .42$, in-game reported fear, $r(216) = .11, p = .10$, reactance, $r(230) = -.00, p = .97$, or immersion, $r(398) = .06, p = .21$. Age was significantly positively correlated with pre-test reported willingness to DUI, $r(200) = .16, p = .02$.

No ethnicity differences were detected for reported pre-test willingness to DUI, $t(200) = -.30, p = 0.76$, willingness to smoke tobacco, $t(226) = -.03, p = 0.98$, willingness to smoke

marijuana, $t(226) = -1.34, p = 0.18$, in-game reported fear, $t(218) = 1.06, p = 0.29$, reactance, $t(228) = 1.47, p = 0.14$, or immersion, $t(218) = .40, p = 0.69$. However, significant ethnicity differences existed for willingness to drink alcohol, $t(226) = -4.17, p < 0.01$, and post-test willingness to DUI, $t(226) = -4.35, p < 0.01$. White participants reported higher willingness to drink alcohol (White Mean = 9.07 SD = 3.47, Non-White Mean = 7.03 SD = 3.91) and higher willingness to DUI (White Mean = 7.09 SD = 2.20, Non-White Mean = 5.75 SD = 2.42) than participants of other ethnicities.

Study 4 Ancillary Results

Regression for willingness to drink alcohol. Regressing willingness to drink alcohol onto experimental condition (C) and immersion (I), with a multiplicative cross-product of the interaction between condition and immersion.

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>	<i>t</i>	<i>Sig</i>	<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>				<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	6.719	.780		8.619	.000	-0.01	0.35	0.70
	<i>C</i>	.369	.459	.067	.804	.423			
	<i>I</i>	.076	.256	.025	.296	.767			
Block 2	<i>Constant</i>	6.728	1.092		6.161	.000	-0.02	0.23	0.87
	<i>C</i>	.353	1.448	.065	.244	.808			
	<i>I</i>	.073	.380	.024	.191	.849			
	<i>C X I</i>	.006	.516	.003	.011	.991			

Gender, age and ethnicity effects. No gender differences were detected for immersion, $t(142) = -1.31$, $p = 0.19$, or for reported willingness to smoke, $t(141) = 1.84$, $p = 0.07$, or drink alcohol, $t(198) = -1.86$, $p = 0.07$. However, a significant gender difference existed for participants' willingness to DUI, $t(141) = 2.40$, $p = 0.02$. Women were less willing to DUI than men (Women Mean = 1.12 SD = 1.29, Men Mean = 1.75 SD = 1.84).

Age was not significantly correlated with immersion, $r(145) = .15$, $p = .07$, willingness to smoke, $r(145) = .08$, $p = .35$, drink alcohol, $r(145) = -.16$, $p = .05$, or DUI, $r(144) = .14$, $p = .10$.

In-Game Measures. Player position in the race correlated significantly with the Spatial Presence subscale, $r(146) = .23$, $p = .01$. Though not statistically significant, player position in the race showed a trend of negatively correlating with just the adapted transportation scale, $r(146) = -.11$, $p = .17$.

Fear Misattribution. Mediated moderation can be tested using the four step method advocated by Baron and Kenny (1986). Step one of this process is to determine whether the interaction of psychological immersion with experiment condition is a significant predictor of DUI and smoking willingness. The interaction of psychological immersion with experiment condition is a significant predictor of DUI willingness, but not a significant predictor of smoking willingness. Therefore, there's no relationship for fear to mediate on the smoking willingness dependent variable. Step two of this process is to determine whether reported fear in response to message is a significant predictor of DUI willingness, which it was not. These results argue against the fear-misattribution hypothesis.

Memory for Images. Psychological immersion may influence the depth to which in-game advertising is processed. High immersion may lead to higher levels of distraction, resulting in poorer memory of in-game posters, or greater focus, resulting in better memory of in-game posters. To examine poster processing, I regressed poster recall on to recall for foil posters, experimental condition (0 for smoking and 1 for DUI) and psychological immersion. In the second block I included multiplicative cross-product tests for an interaction between psychological immersion and experimental condition.

<i>Model</i>	<i>Predictor</i>	<i>Unstandardized</i>		<i>Standardized</i>			<i>Adjusted R²</i>	<i>F Change</i>	
		<i>B</i>	<i>SE</i>	<i>Beta</i>	<i>t</i>	<i>Sig</i>		<i>Estimate</i>	<i>p-value</i>
Block 1	<i>Constant</i>	2.68	0.25		10.56	0.00	0.37	29.57	0.00
	<i>F</i>	0.61	0.08	0.54	7.61	0.00			
	<i>C</i>	-1.05	0.14	-0.55	-7.73	0.00			
	<i>I</i>	-0.17	0.07	-0.15	-2.33	0.02			
Block 2	<i>Constant</i>	3.28	0.33		10.07	0.00	0.40	7.97	0.01
	<i>F</i>	0.60	0.08	0.53	7.67	0.00			

<i>C</i>	-2.08	0.39	-1.09	-5.34	0.00		
<i>I</i>	-0.38	0.10	-0.35	-3.69	0.00		
<i>C X I</i>	0.39	0.14	0.60	2.82	0.01		

In Block 2 of the above regression, controlling for foil poster recall, $B = 1.35$, $t(141) = 3.68$, $p < 0.01$, the interaction between psychological immersion and experimental condition was significant, $B = 0.39$, $t(141) = -2.82$, $p = 0.01$ (see above).

Breaking down this effect by condition, the effect of immersion was to reduce recall in the anti-smoking poster condition, $B = -0.36$, $t(58) = -2.99$, $p < 0.01$. In contrast, in the anti-DUI poster condition, there was no significant main effect of immersion on recall, $B = -0.01$, $t(86) = -0.17$, $p = 0.86$. These findings show that recall for in-game posters was predicted to be lower if a participant was highly immersed in the game in the anti-smoking poster condition, but that immersion didn't influence recall at all if a participant was in the anti-DUI poster condition.

Appendix B
Questionnaire Scales used in Study 1

Video Game Questionnaire

Circle the number under each question that best represents your opinion about the video game you just played.

1. While I was playing the video game, I could easily picture the events in it taking place.

1	2	3	4	5	6	7
not at all						very much

2. I could picture myself in the scene of the events shown in the video game.

1	2	3	4	5	6	7
not at all						very much

3. I was mentally involved in the video game while playing it.

1	2	3	4	5	6	7
not at all						very much

4. After the video game ended, I found it easy to put it out of my mind.

1	2	3	4	5	6	7
not at all						very much

5. I wanted to learn how the video game ended.

1	2	3	4	5	6	7
not at all						very much

6. The video game affected me emotionally.

1	2	3	4	5	6	7
not at all						very much

7. I found myself thinking of ways the video game could have turned out differently.

1	2	3	4	5	6	7
not at all						very much

8. I found my thoughts wandered while playing the video game

1	2	3	4	5	6	7
not at all						very much

9. The events in the video game changed life

1	2	3	4	5	6	7
not at all						very much

10. I had a vivid image of the video game's hero

1	2	3	4	5	6	7
not at all						very much

11. I enjoyed game

1	2	3	4	5	6	7
not at all						very much

12. I felt engrossed in game

1	2	3	4	5	6	7
not at all						very much

Health Choices

We would like to know your attitude towards risky health choices. Below are listed a range of actions people sometimes engage in, whether they think it is a good idea or not. We would like to know your attitudes towards each of these actions. Please answer as honestly as possible. You may skip any items.

1. Drinking alcohol to the point of intoxication

I feel _____ about drinking alcohol to the point of intoxication

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Negative		Negative		Negative		Negative				Positive		Positive		Positive		Positive

How important is it for you to never drink to the point of intoxication?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Important			Important			Important			Important

If I had an opportunity on a Friday night to drink alcohol to the point of intoxication, I would be _____

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How likely is it that you will drink to the point of intoxication at some point in the next 30 days?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Likely			Likely			Likely			Likely

2. Smoking cigarettes

I feel _____ about smoking cigarettes

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Negative		Negative		Negative		Negative				Positive		Positive		Positive		Positive

How important is it for you to never smoke a cigarette?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Important			Important			Important			Important

If a friend of mine was smoking cigarettes and offered me one, I would be _____ to smoke the cigarette

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How likely is it that you will smoke a cigarette at some point in the next 30 days?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Likely			Likely			Likely			Likely

3. Driving a motor vehicle under the influence of alcohol.

I feel _____ about driving a motor vehicle under the influence of alcohol

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Negative		Negative		Negative		Negative				Positive		Positive		Positive		Positive

How important is it for you to never drive under the influence of alcohol?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Important			Important			Important			Important

If I was feeling a “slight buzz” from drinking alcohol and a friend wanted me to drive, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

If I am out at a party with my friends and have had 3 or 4 drinks, I would be _____ to drive my group to the next party.

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How likely is it that, in the next 30 days, you drive a motor vehicle after you have consumed a moderate amount of alcohol (i.e., enough to where you are feeling some effects)?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Likely			Likely			Likely			Likely

How willing would you be to drive a motor vehicle after you have consumed large amount of alcohol, if there was a fun party to attend and a friend wanted you to drive?

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

4. Smoking marijuana/pot

I feel _____ about smoking marijuana

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Negative		Negative		Negative		Negative				Positive		Positive		Positive		Positive

How important is it for you to never smoke marijuana?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Important			Important			Important			Important

If a friend of mine was smoking marijuana and offered me a hit, I would be _____ to smoke.

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How likely is it that you will smoke marijuana at some point in the next 30 days?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Likely			Likely			Likely			Likely

Questionnaire Scales used in Study 2

Below is a list of actions that many would disagree with. That is, many people would argue that these are behaviors that they would disapprove of and avoid engaging in at some cost. Having said that, all of us have engaged in actions we disagree with at some time and not every “bad” behavior is as bad as every other. We would like you to think about the following actions and indicate negatively or positively you judge these actions to be.

For this questionnaire, we specifically are interested in your judgments of your own behavior. That is, imagine that you have engaged in these actions and indicate how you would evaluate them. We realize that you might not be willing to engage in some of these actions and so you can indicate this by rating your disapproval of the action.

Tell a lie to a close friend for monetary gain

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Tell a lie to an acquaintance for monetary gain

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Murder someone in a fit of unexpected rage

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cheat on a spouse the week of your wedding

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cheat on a spouse after 10 years of marriage

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cheat on an exam to avoid failing a class

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cheat on a take-home work assignment that is less than 1% of your grade

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Drive 70 miles per hour in a school zone to avoid being late for class

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Dropping a cat from a 2nd story window to see if it will land on its feet

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Drive 100 miles per hour after midnight on a deserted back road

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Drive a motor vehicle after having had two alcoholic drinks

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Kicking a dog that is barking because you are angry

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Sprinkling salt on a slug as a means of killing it

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Help another student cheat on an exam to gain their romantic interest

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Lie to a stranger just to see if you can get away with it

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Drive a car home from a party after you're feeling "buzzed" but not drunk

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Killing a spider rather than taking it outside

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Spanking a child to teach them not to interrupt adults

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cut someone off on the highway to express your anger at their driving

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Driving a car while texting

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Spanking a child to teach them not to run with sharp objects

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Boiling a lobster for dinner

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Cheating on a girlfriend or boyfriend in college

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Lying to protect a friend from getting caught cheating on a boyfriend/girlfriend

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Becoming sexually involved with someone who is cheating on a spouse

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Driving a motor vehicle for 5 miles after reaching the legal drinking limit

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Help to drive a friend home when you're slightly feeling some initial effects from having a few alcoholic drinks

-1	0	1	2	3	4	5	6
I approve of this action to at least some degree	I feel neutral	I disapprove of this action slightly	I disapprove of this action moderately	I disapprove of this action	I very much disapprove of this action	I disapprove of this action extremely	I completely disapprove of this action

Video Game Questionnaire

While I was playing the game, I could easily picture the events in it taking place.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

While I was playing the game, activity going on in the room around me was on my mind.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

I could picture myself in the scene of the events from the game.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

I was mentally involved in the video game.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

After the video game ended, I found it easy to put it out of my mind.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

I wanted to learn how the video game ended.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

The game affected me emotionally.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

I found myself thinking of ways the video game could have turned out differently.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

I found my mind wandering while playing the game.

1	2	3	4	5	6	7
Strongly	Moderately	Slightly	Neither	Slightly	Moderately	Strongly
Disagree	Disagree	Disagree		Agree	Agree	Agree

The events in the video game are relevant to my everyday life.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

The events in the video game have changed my life.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

I had a vivid mental image of the hero in the video game.

1	2	3	4	5	6	7
Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree

Game Fear Questions

Please answer the following questions about your experience of the video game that you just played.

How frightened did you feel while playing the game?

1	2	3	4	5	6	7
Not at all frightened	Slightly frightened	Somewhat frightened	Pretty frightened	Quite frightened	Very frightened	Extremely frightened

How anxious did you feel while playing the game?

1	2	3	4	5	6	7
Not at all anxious	Slightly anxious	Somewhat anxious	Pretty anxious	Quite anxious	Very anxious	Extremely anxious

How uncomfortable did you feel while playing the game?

1	2	3	4	5	6	7
Not at all uncom- fortable	Slightly uncom- fortable	Somewhat uncom- fortable	Pretty uncom- fortable	Quite uncom- fortable	Very uncom- fortable	Extremely uncom- fortable

Driving a motor vehicle under the influence of alcohol.

I feel _____ about driving a motor vehicle under the influence of alcohol

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Negative		Negative		Negative		Negative				Positive		Positive		Positive		Positive

How important is it for you to never drive under the influence of alcohol?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Important			Important			Important			Important

If I was feeling a “slight buzz” from drinking alcohol and a friend wanted me to drive, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

If I am out at a party with my friends and have had 3 or 4 drinks, I would be _____ to drive my group to the next party.

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How willing would you be to drive a motor vehicle after you have consumed large amount of alcohol, if there was a fun party to attend and a friend wanted you to drive?

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

If I was feeling slight effects from having a few alcoholic drinks but not yet out of control, I would be ____ to drive.

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely Unwilling		Extremely Unwilling		Quite Unwilling		Slightly Unwilling		Neutral		Slightly Willing		Quite Willing		Extremely Willing		Completely Willing

If I was starting to feel a few of early physiological effects from drinking alcohol but not at a point I would call myself "drunk", I would be ____ to drive.

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely Unwilling		Extremely Unwilling		Quite Unwilling		Slightly Unwilling		Neutral		Slightly Willing		Quite Willing		Extremely Willing		Completely Willing

If I felt a little tipsy after a party and it was time to go home, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely Unwilling		Extremely Unwilling		Quite Unwilling		Slightly Unwilling		Neutral		Slightly Willing		Quite Willing		Extremely Willing		Completely Willing

If I had drunk 3 or 4 drinks and couldn't get a taxi, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely Unwilling		Extremely Unwilling		Quite Unwilling		Slightly Unwilling		Neutral		Slightly Willing		Quite Willing		Extremely Willing		Completely Willing

If I had drunk 3 or 4 drinks and felt sober, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely Unwilling		Extremely Unwilling		Quite Unwilling		Slightly Unwilling		Neutral		Slightly Willing		Quite Willing		Extremely Willing		Completely Willing

If I was feeling a “slight buzz” from drinking alcohol and I needed to go somewhere because of an emergency, I would be _____ to drive

-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
Completely		Extremely		Quite		Slightly		Neutral		Slightly		Quite		Extremely		Completely
Unwilling		Unwilling		Unwilling		Unwilling				Willing		Willing		Willing		Willing

How likely is it that, in the next 30 days, you drive a motor vehicle after you have consumed a moderate amount of alcohol (i.e., enough to where you are feeling some effects)?

0	1	2	3	4	5	6	7	8	9
Not at All			Slightly			Quite			Extremely
Likely			Likely			Likely			Likely

Questionnaire Scales used in Study 3 and 4

Pre measure:

How likely is it that you will smoke a cigarette sometime today?

Not at all Likely Slightly Likely Quite Likely Extremely Likely

How likely is it that you will smoke a cigarette sometime in the next 5 days?

Not at all Likely Slightly Likely Quite Likely Extremely Likely

I feel _____ about driving a motor vehicle under the influence of alcohol

Completely	Extremely	Quite	Slightly	Neutral		Slightly	Quite	Extremely
Completely								
Negative	Negative	Negative	Negative			Positive	Positive	Positive

I feel _____ about smoking a cigarette

Completely	Extremely	Quite	Slightly	Neutral		Slightly	Quite	Extremely
Completely								
Negative	Negative	Negative	Negative			Positive	Positive	Positive

I _____ of someone who would drive a motor vehicle under the influence of alcohol

Disapprove	Disapprove	Disapprove	Disapprove		Approve	Approve	Approve	Approve
Completely	Extremely	Quite a Bit	Slightly	Am Neutral	Slightly	Quite a Bit	Extremely	Completely

I _____ of someone who smokes cigarettes

Disapprove	Disapprove	Disapprove	Disapprove		Approve	Approve	Approve	Approve
Completely	Extremely	Quite a Bit	Slightly	Am Neutral	Slightly	Quite a Bit	Extremely	Completely

If I was feeling a “slight buzz” from drinking alcohol and a friend wanted me to drive, I would be _____ to drive

Completely	Extremely	Quite	Slightly	Neutral	Slightly	Quite	Extremely	Completely
Unwilling	Unwilling	Unwilling	Unwilling		Willing	Willing	Willing	Willing

If someone offered me a cigarette to smoke in a social setting, I would be _____.

Completely	Extremely	Quite	Slightly	Neutral	Slightly	Quite	Extremely	Completely
Unwilling	Unwilling	Unwilling	Unwilling		Willing	Willing	Willing	Willing

Presence

To what extent did you feel mentally immersed in the experience?

1	2	3	4	5	6	7
Not at all immersed	Slightly immersed	Somewhat immersed	Pretty immersed	Quite immersed	Very immersed	Extremely immersed

How involving was the experience?

1	2	3	4	5	6	7
Not at all involving	Slightly involving	Somewhat involving	Pretty involving	Quite involving	Very involving	Extremely involving

How completely were your senses engaged?

1	2	3	4	5	6	7
Not at all engaged	Slightly engaged	Somewhat engaged	Pretty engaged	Quite engaged	Very engaged	Extremely engaged

To what extent did you experience a sensation of reality?

1	2	3	4	5	6	7
Not at all	Slightly	Somewhat	Pretty	Quite	Very	Extremely

How relaxing or exciting was the experience?

1	2	3	4	5	6	7
Very relaxing	Moderately relaxing	Slightly relaxing	Niether	Slightly exciting	Moderately exciting	Very exciting

How much did it seem as if the objects and people you saw/heard had come to the place you were?

1	2	3	4	5	6	7
Not at all	Slightly	Somewhat	Pretty	Quite	Very	Extremely

How much did it seem as if you could reach out and touch the objects or people you saw/heard?

1	2	3	4	5	6	7
Not at all	Slightly	Somewhat	Pretty	Quite	Very	Extremely

How often when an object seemed to be headed toward you did you want to move to get out of its way?

1	2	3	4	5	6	7
Never		Sometimes		Quite often		Always

To what extent did you experience a sense of being there inside the environment you saw/heard?

1	2	3	4	5	6	7
Not at all	Slightly	Somewhat	Pretty	Quite	Very	Extremely

1	2	3	4	5	6	7
Not at all	Slightly	Somewhat	Pretty	Quite	Very	Extremely

1	2	3	4	5	6	7
Never		Sometimes		Quite often		Always

1	2	3	4	5	6	7
Very like a movie screen	Moderately like a movie screen	Slightly like a movie screen	Niether	Slightly like a window	Moderately like a window	Very like a window

Now we'd like to know about your opinions regarding the DUI posters that you saw in the game. Answer the following questions about the DUI posters that you saw while you were in the game. How frightening were the DUI posters that you saw in game?

1	2	3	4	5	6	7
Not at all frightening	Slightly frightening	Somewhat frightening	Pretty frightening	Quite frightening	Very frightening	Extremely frightening

1	2	3	4	5	6	7
Not at all anxiety provoking	Slightly anxiety provoking	Somewhat anxiety provoking	Pretty anxiety provoking	Quite anxiety provoking	Very anxiety provoking	Extremely anxiety provoking

1	2	3	4	5	6	7
Not at all discom- forting	Slightly discom- forting	Somewhat discom- forting	Pretty discom- forting	Quite discom- forting	Very discom- forting	Extremely discom- forting

Cued recall test anti-DUI poster foils taken from Studies 3 and 4

Now we will show you different posters and ask you whether you saw these posters on the walls in the video game that you just played. Take a look at each poster before rating whether you feel like you saw the poster in the game or not.



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



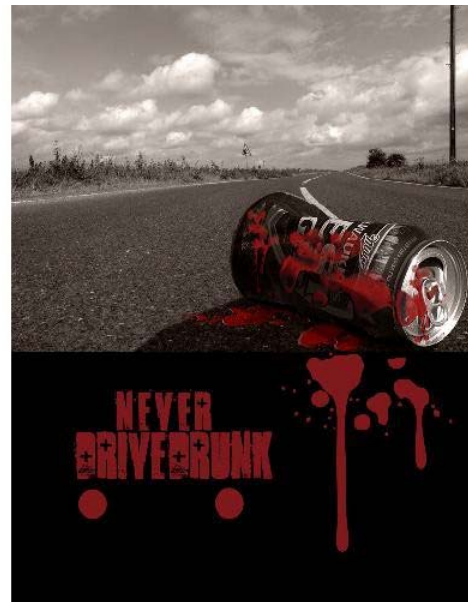
I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



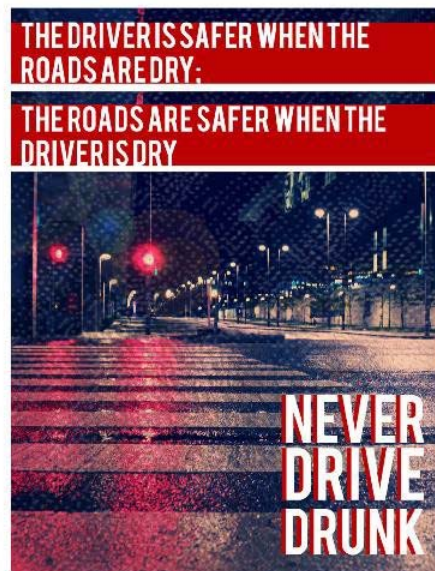
I think I did not see this poster



No clue



I think I did see this poster





Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



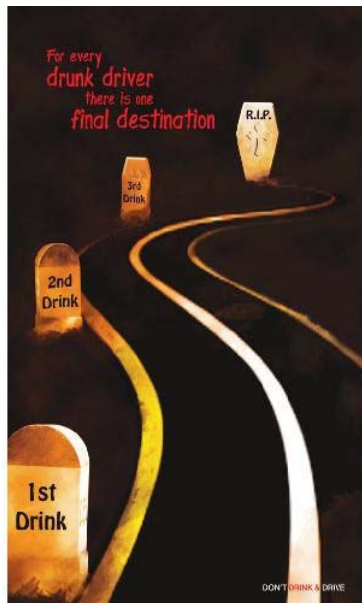
I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



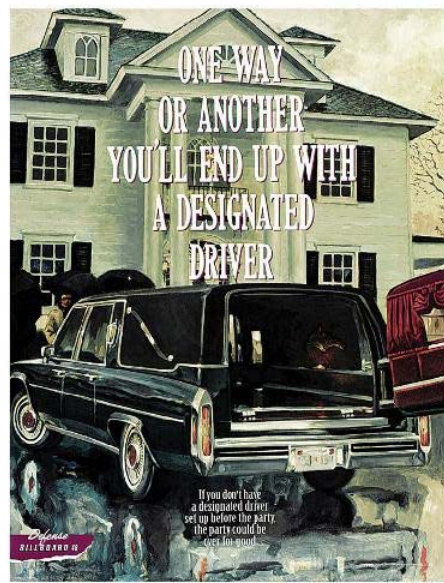
I think I did not see this
poster

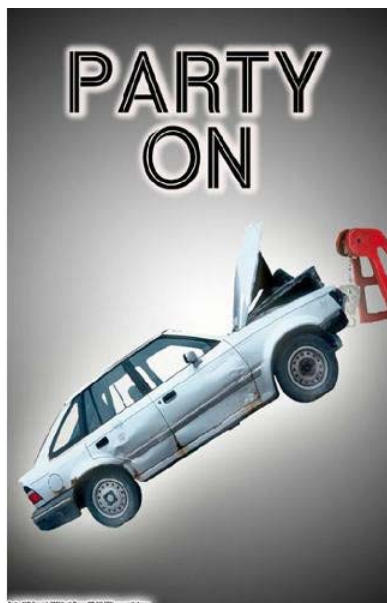


No clue



I think I did see this
poster





Did you see this poster in the video game?

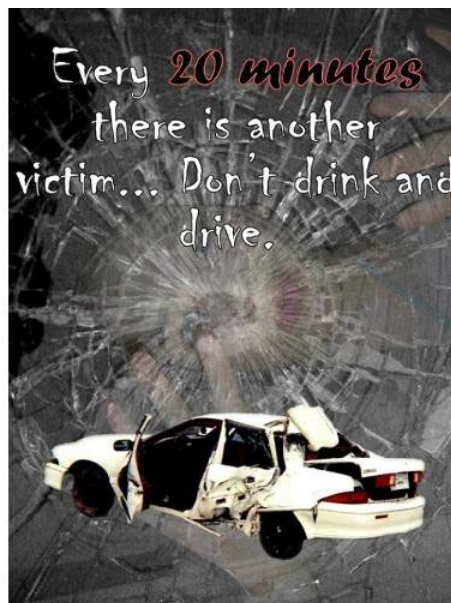
I know I definitely did not see this poster

☐

I think I did not see this poster

☐

No clue

☐


Did you see this poster in the video game?

I think I did see this poster

☐

I know I definitely did not see this poster

☐

I think I did not see this poster

☐

No clue

☐

I think I did see this poster

☐

Cued recall test anti-DUI posters shown in-game taken from Studies 3 and 4

Now we will show you different posters and ask you whether you saw these posters on the walls in the video game that you just played. Take a look at each poster before rating whether you feel like you saw the poster in the game or not.



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster





Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster





Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Cued recall test for anti-smoking posters shown in-game taken from Study 4

Now we will show you different posters and ask you whether you saw these posters on the walls in the video game that you just played. Take a look at each poster before rating whether you feel like you saw the poster in the game or not.



Did you see this poster in the video game?

I know I definitely did
not see this poster



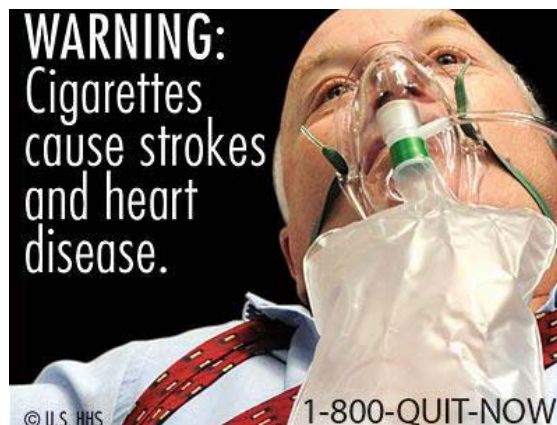
I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster





WARNING: Cigarettes cause strokes and heart disease.

Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



WARNING: Cigarettes cause cancer.

Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster





**WARNING:
Cigarettes
cause
cancer.**

Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



**WARNING: Cigarettes
cause fatal lung disease.**

Did you see this poster in the video game?

I know I definitely did
not see this poster



I think I did not see this
poster



No clue



I think I did see this
poster



Cued recall test for anti-smoking foil posters shown in-game taken from Study 4

Now we will show you different posters and ask you whether you saw these posters on the walls in the video game that you just played. Take a look at each poster before rating whether you feel like you saw the poster in the game or not.



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see poster





Did you see this poster in the video game?

I know I definitely did not see this poster



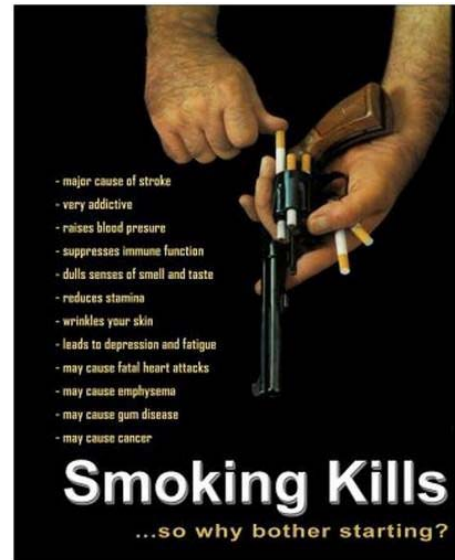
I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see poster



Did you see this poster in the video game?

I know I definitely did not see this poster



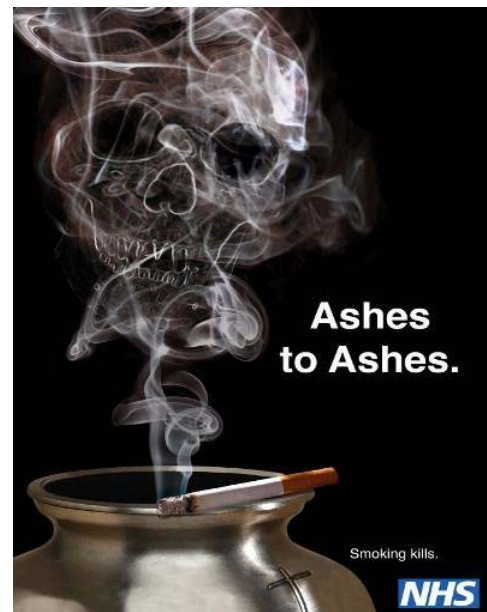
I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see poster





Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see this poster



Did you see this poster in the video game?

I know I definitely did not see this poster



I think I did not see this poster



No clue



I think I did see poster

