Journal of Media Psychology

Virtual Exemplars in Health Promotion Campaigns: Heightening Perceived Risk and Involvement to Reduce Soft Drink Consumption in Young Adults

Sun Joo (Grace) Ahn

Online First Publication, August 26, 2016. http://dx.doi.org/10.1027/1864-1105/a000184

Original Article

Virtual Exemplars in Health Promotion Campaigns

Heightening Perceived Risk and Involvement to Reduce Soft Drink Consumption in Young Adults

Sun Joo (Grace) Ahn

Department of Advertising and Public Relations, and Grady College of Journalism & Mass Communication, University of Georgia, Athens, GA, USA

Abstract: Virtual simulations allow individuals to concretely view the future negative health consequences of present dietary choices. Integrating exemplification theory with risk communication research, the effect of using virtual simulations to exemplify the health risks of soft drink consumption was assessed across 3 weeks. A three-group pretest, posttest, and delayed posttest design (N = 62) compared the effect of three channels of delivering health risk information – base-rate statistics, picture, and virtual simulation – embedded in a digital health promotion pamphlet. Three dimensions of risk perception (perceived likelihood, susceptibility, severity), involvement with the health issue, and soft drink consumption were measured across 3 weeks. Virtual exemplars were the most effective channel for increasing perceived likelihood, perceived susceptibility, involvement, and soft drink consumption over time. Exemplification did not affect perceived severity. The paper discusses the potential of virtual exemplars as a powerful tool in designing effective health messages.

Keywords: exemplification theory, virtual simulations, risk perception, health promotion campaigns, obesity, soft drinks

Soft drinks have become a major contributor to the rising rates of obesity (Hu & Malik, 2010), and a primary source of added sugars and excessive energy intake (Johnson et al., 2009). In particular, between 1994 and 2002, the intake of added sugars remained high and unchanged among 14–18-year-olds and even increased among those aged 20 years and older (Johnson et al., 2009), indicating that younger individuals consume significantly greater amounts of soft drinks than adults do (West et al., 2006). To this extent, young adults should be considered a priority in primary prevention efforts to reduce soft drink consumption.

Guided by the framework of exemplification theory (Zillmann, 1999) and risk communication research, the current study makes several contributions to health communication research. First, the use of concrete, illustrative, and representative cases of a phenomenon –*exemplars* – to highlight the perceived health risk of soft drink consumption was tested within the context of a real-world health promotion campaign to observe their effects on health behavior. In addition, the effect of virtual simulations as a novel channel of exemplification was tested and compared against traditional exemplars and statistical information. Furthermore, changes in the perception of health risk, involvement regarding the health issue, and health behavior as a result of viewing health messages with exemplars were explored across 3 weeks to investigate the persistence of exemplification effects. The relationships between exemplification channels, perceived risk, and health behavior were also explored.

Exemplification Theory: The Persuasive Power of Examples

Much of human communication involves the use of exemplars, which are illustrative case reports that depict typical characteristics of a person, object, or an event. Exemplification theory (Zillmann, 1999, 2006) argues that when individuals are exposed to exemplars, three types of heuristics automate a processing system that drives individuals to perceive the exemplar as representative of the entire phenomenon. First, the quantification heuristic drives individuals to infer the seriousness and frequency of a phenomenon based on exemplars. For example, upon observing concrete cases of an illness, an individual is likely to assume that the illness occurs frequently and thus perceives greater health risk than those who have not seen concrete cases. Second, the representativeness heuristic

DOI: 10.1027/1864-1105/a000184

(Kahneman & Tversky, 1973) drives individuals to construct an impression of a phenomenon based on limited information obtained from exemplars, thinking that the small number of examples represent the whole. Relatedly, the base-rate fallacy (Bar-Hillel, 1980) predicts that providing numerical information (i.e., base-rate information: data based on numbers without exemplars, such as statistics) is less influential than exemplars because individuals consider the base-rate information to be immaterial or secondary. Finally, the availability heuristic (Kahneman, 2001) proposes that individuals are likely to rely on exemplars to form beliefs because concrete examples tend to be more cognitively accessible than abstract information such as numbers. Health communicators may take advantage of these heuristics by incorporating exemplars in health risk information to effectively persuade readers to avoid future risks.

Risk Perception and Health Behavior Change

Risk perception stands at the core of most health behavior theories because of its strong correlation to behavior change (Brewer et al., 2007). The anticipation of, and the desire to avoid, negative health outcomes (i.e., risk perception) motivates health behavior change for self-protection (Weinstein, 1993). As such, constructing health messages that meaningfully heighten risk perceptions may be an effective approach to promoting desirable health behaviors.

Individuals conceptualize health problems in terms of causes and consequences and understand health risks based on their ability to mentally simulate or imagine themselves experiencing negative health consequences (Armor & Taylor, 1998). Because the negative effects of soft drink consumption, such as weight gain, are gradual over time, the temporal distance between the cause (e.g., soft drink consumption) and the effect (e.g., obesity and obesity-related problems) may render this causal relationship abstract. Imagining future negative health consequences may then become difficult, leading to misperceptions of low risk.

This is particularly a concern with young adults; compared to mature adults, young adults fail to adopt healthy behaviors despite exposure to information about health risk (Schwarzer & Renner, 2000). Some studies find that young adults' unrealistic optimism leads them to believe that they are less susceptible to negative health consequences (Weinstein, 1980). Others have demonstrated that young adults underestimate the severity of future health consequences (Cohn, Marcfarlane, Yanez, & Imai, 1995). Thus, constructing health messages that provide a salient and concrete link between present health behaviors and future negative health consequences for seemingly benign health choices, such as soft drink consumption, may be an effective means for heightening risk perceptions and motivating young adults to adopt desirable health behaviors.

Exemplifying Health Risk to Heighten Risk Perception

Providing contextual information through exemplars when presenting health risks may be an effective way to heighten risk perceptions. For instance, individuals demonstrated decreased intentions to tan when they were exposed to an exemplar of a young woman who developed skin cancer through tanning bed use compared with those who were exposed to a statistical message with numerical evidence about tanning bed use and skin cancer risk (Greene & Brinn, 2003).

Zillmann (2006) notes that exemplars may be delivered through different media channels, and evidence indicates that visual exemplars may be more influential than verbal exemplars in heightening risk perceptions. For instance, a study found that a print advertisement for organ donation with a picture exemplar (i.e., an exemplar presented in the form of a picture) elicited greater intentions to donate than an advertisement without picture exemplars or with base-rate statistics only (Uribe, Manzur, & Hidalgo 2013). Zillmann, Gibson, and Sargent (1999) also confirmed that the inclusion of a picture exemplar modified how individuals interpreted the same article about financial risks, always in the direction suggested by the photograph. Outside the realm of exemplification theory, a number of channel studies have compared the persuasive effect of visual against verbal messages. The picture-superiority effect (Childers & Houston, 1984) argues that visual images enhance individuals' recall of the information. Pictures provide concrete and realistic cues that are easier to label, resulting in greater cues that assist recall (Paivio, 1986). Thus, constructing exemplars that emphasize visual elements may be an effective strategy for high-impact health messages.

Although Zillmann (2006) has discussed the utility of exemplars in heightening the perception of health risks, or what he refers to as *health worries*, the conceptualization of risk in the context of exemplification theory has been general and broad. Further examination of the risk communication literature suggests that perceived risk comprises multiple dimensions: perceived likelihood (one's probability of being harmed), perceived susceptibility (individual resistance or constitutional vulnerability), and perceived severity (the extent of harm a hazard would cause; Brewer et al., 2007).

These dimensions (perceived likelihood, perceived susceptibility, perceived severity) seem to map well onto the

three heuristics (quantification, availability, representative) that drive exemplification effects. First, the quantification heuristic, which refers to the way individuals who are exposed to concrete exemplars of an event tend to infer that the event occurs frequently, is related to the perceived likelihood dimension of risk (i.e., probability of harm). Second, the availability heuristic refers to the way exemplars yield greater influence than statistical information because they are more easily accessible in an individual's mind. It is likely that the more readily available information is, the easier it is to mentally simulate in an individual's mind, helping to form beliefs that the risk may be an imminent threat to the self. This is related to the perceived susceptibility dimension of risk (i.e., perceived vulnerability). Finally, the representative heuristic, which refers to the way individuals who are exposed to exemplars infer an impression of an entire event based on the sliver of information in the exemplar, is related to the perceived severity dimension of risk (i.e., extent of harm). The current study aims to build on Zillmann's (2006) discussion of using exemplars to heighten the global perception of risk by systematically investigating exemplification effects on the three dimensions of risk perception.

Virtual Simulation as a Channel of Exemplification

In the risk communication literature, scholars prescribe the use of simulations that depict concrete future consequences to evoke visceral reactions toward risk issues (Armor & Taylor, 1998). Virtual simulations, computer-rendered environments that digitally depict hypothetical events, can concretely present changes between the present and the future in mere seconds, and this virtual acceleration of time can help reduce perceived temporal distances between present health behaviors and future health consequences (Ahn, 2015). In the current study, a virtual simulation was developed as an exemplar to illustrate the health consequences of soft drink consumption: The process of a virtual human gaining a significant amount of weight as a result of regularly drinking soft drinks over the years was digitally depicted. We label the virtual simulations used to exemplify information given in a message as *virtual exemplars*.

Virtual simulations have been shown to promote health behaviors via varying mechanisms, including modeling (Ahn, Johnsen, Moore, Brown, Biersmith, & Ball, 2016; Fox & Bailenson, 2009), self-relevant thoughts (Ahn, Fox, & Hahm, 2014), or perceived self-efficacy (Ahn et al., 2015). However, experimental stimuli in these studies were presented as independent, discrete experiences rather than an exemplar integrated into a message. Furthermore, the perception of risk over time as a result of exposure to virtual simulation and its effect on health behavior change has rarely been explored.

In the current study, virtual and picture exemplars were digitally embedded in a health promotion pamphlet developed to reduce soft drink consumption. Embedded in a pamphlet, the exemplars do not deliver new information content outside of what is already described through numbers and statistics in the pamphlet. Rather, they serve to highlight a segment of the information presented in the pamphlet as an illustrative case (e.g., soft drink consumption leads to weight gain). The current study builds on earlier findings and investigates the strength of virtual exemplars as a channel of exemplification in highlighting existing health information provided via traditional channels and heightening risk perceptions to promote healthy behaviors.

The inclusion of the virtual exemplar in a health pamphlet is likely to help individuals create a more concrete mental image of the health risk discussed in the pamphlet compared with the same information presented through numbers and statistics, without an exemplar:

> *Hypothesis 1 (H1)*: Immediately following treatment, virtual exemplars will elicit higher perceived likelihood (H1A), perceived susceptibility (H1B), and perceived severity (H1C) than base-rate statistics.

The dynamic illustration presented in the virtual exemplar (e.g., illustrating the process of weight gain through an accelerated depiction of time) is likely to provide a more realistic and concrete mental image of how the health risk leads to negative future consequences compared with a static picture exemplar. As strong connections between present causes and future consequences lead to high perceptions of risk (Leventhal, Nerenz, & Steele, 1984), the following is hypothesized:

> *Hypothesis 2 (H2)*: Immediately following treatment, virtual exemplars will elicit higher perceived likelihood (H2A), perceived susceptibility (H2B), and perceived severity (H2C) than picture exemplars.

Related research has shown that virtual simulations that heighten risk perceptions also significantly increase the perception of personal relevance (Ahn, Fox, et al., 2014). Tenets of the elaboration likelihood model (Petty & Cacioppo, 1986) suggest that increased relevance leads to attention and elaboration of the message (i.e., deeper processing) and ultimately to persuasion and should thus be investigated in the current study as an important

contributor to health behavior change. If virtual exemplars are indeed able to heighten risk perceptions of soft drink consumption, it is likely for individuals exposed to the health message to feel relevant to and involved with the issue of soft drink consumption:

Hypothesis 3 (H3): Immediately following treatment, virtual exemplars will elicit greater perceived involvement with the issue of soft drink consumption than base-rate statistics (H3A) and picture exemplars (H3B).

The increase in risk perception and high involvement with the health issue is likely to motivate an increase in intentions to reduce soft drink consumption:

Hypothesis 4 (H4): Immediately following treatment, virtual exemplars will elicit lower intentions to consume soft drinks than base-rate statistics (H4A) and picture exemplars (H4B).

Finally, many studies investigating behavioral change have stopped at assessing behavioral intentions immediately following experimental treatments rather than evaluating actual behavioral change. Few studies, if any, have systematically investigated the change in risk perception and ensuing health behavior change as a result of exposure to messages sent through different channels. Thus, in addition to comparing the effects of health messages that feature base-rate statistics only, picture exemplars, and virtual exemplars, changes in these message effects were assessed over 3 weeks in time:

Research Question 1 (RQ1): How will perceptions of risk (susceptibility, likelihood, severity) (RQ1A), and perceptions of issue involvement (RQ1B) change from 1 week prior to treatment, to immediately following exposure to treatment, and to 1 week following exposure to treatment?

Research Question 2 (RQ2): How will soft drink consumption behavior change from 1 week prior to treatment (baseline), to immediately following exposure to treatment (consumption intention), and to 1 week following exposure to treatment (consumption)?

Finally, the role of all three dimensions of risk and involvement in reducing consumption intention and ultimately consumption behavior were investigated to explore underlying mechanisms of the exemplification effect.

Research Question 3 (RQ3): Do risk perception (susceptibility, likelihood, severity) and involvement mediate the relationship between media channels and consumption behavior?

Method

Experimental Design and Participants

This study employed a 3 × 3 mixed design, whereby three exemplification channels (no exemplar base-rate statistics only; picture exemplar; virtual exemplar) were compared and measurements were assessed at three different time points spaced at least 1 week apart (pretest, posttest, delayed posttest) to gauge the effects of exemplars on health risk perception, involvement, and soft drink consumption over time. The original sample at Time 1 (N = 81) consisted of 67 women and 14 men, aged 18–24 years (M = 20.07, SD = 1.23). On average, the participants spent 3.26 hr a week (SD = 5.90) playing video, computer, and mobile games. No participant reported dietary restrictions or health concerns (e.g., diabetes) that prevented them from consuming sugar. Eleven participants were lost to follow-up 1 week later at Time 2, and three more were lost the following week at Time 3. Five more participants were excluded from the final dataset owing to failure in following instructions, bringing the final sample to N = 62 (males = 10). The majority of the participants were White Caucasian (80%), with some African Americans (10%), Asians (8%), and Hispanics (2%).

Stimuli

A health bulletin issued by the New York City Department of Health and Mental Hygiene as a part of the "Pouring on the Pounds" campaign was adopted as the stimulus. The six-page pamphlet provided information and statistics on how soft drinks lead to weight gain. The pamphlet warned that an average of 10 pounds a year might be gained as a result of consuming the extra calories and presented a picture of a cup filled with fat, ostensibly being poured from a soft-drink bottle. The first five pages of the pamphlet were kept the same, and the stimuli used in the exemplar conditions was embedded in the sixth page.

For the virtual exemplar condition (n = 22), participants were given a pamphlet featuring an embedded recording of a virtual simulation, ready to play on demand. Participants clicked the play button to view the health consequence of soft drink consumption. The virtual exemplar depicted a same-sex college student (virtual human) drinking one soft drink a day for 2 years and gaining 20 pounds of weight. Two years in the virtual world was portrayed in 2 min in the physical world and the passing of

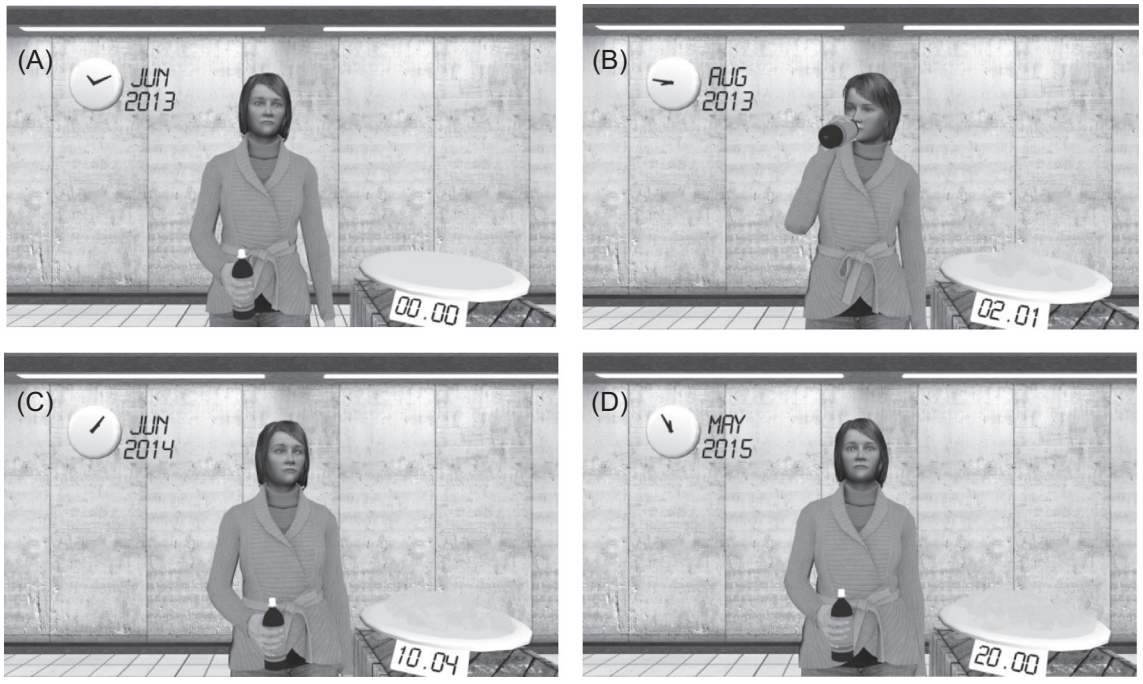

Figure 1. Screenshot of events in the virtual exemplar. Participants entered the virtual world and saw a virtual agent standing in a room, holding a soft drink (A). As the virtual agent began drinking, the calendar and clock in the background portrayed the rapid passing of time, and fat began to fall on the digital scale (B). After 1 year of consuming soft drinks, the virtual agent gained 10 pounds (C). At the end of 2 years, the virtual agent gained a total of 20 pounds as shown on the scale (D).

time was represented by a digital calendar flipping through the years and a clock with its hands rapidly turning. As the virtual agent consumed the soft drink throughout the years, its body grew larger because of weight gain. The participants also saw and heard the 20 pounds of fat splattering onto a digital scale, comparable to the cup full of fat depicted on the pamphlet (Figure 1).

For the picture exemplar condition (n = 22), participants were given a pamphlet featuring an exemplar with a side-by-side presentation of before-and-after pictures. One picture was the first screen of the virtual exemplar, depicting a same-sex college student in the year 2013 drinking a soft drink. The other picture was the last screen of the virtual exemplar, depicting the college student in the year 2015 after she/he gained 20 pounds with the total amount of fat piled on a digital scale (Appendix). For the base-rate-only condition (n = 18), participants received the original pamphlet with statistics and numerical information on soft drink consumption and obesity. In this condition, no exemplars were included.

Procedure

The experiment was conducted in three online interactions. One week before the experiment (Time 1), participants responded to an online pretest measuring their baseline soft drink consumption, risk perception (i.e., perceived likelihood, susceptibility, severity), involvement, and demographic information. One week later (Time 2), participants were randomly assigned to an experimental condition and received a link to an online survey. The link guided all participants to open a digital health pamphlet manipulated for the participants' respective experimental condition. After reading the pamphlet, the participants completed an online survey. One week following experimental treatments (Time 3), all participants received an e-mail asking about their soft drink consumption, risk perception, and involvement.

Measures

Perceived Likelihood

At Times 1, 2, 3 (Cronbach's α = 0.89, α = 0.84, α = 0.82, respectively), perceived likelihood was measured with two 5-point interval scale items asking participants how likely they thought they would gain weight and how likely they thought they would become obese as a result of drinking soft drinks (1 = *not likely at all*, 5 = *completely likely*).

Perceived Susceptibility

At Times 1, 2, 3 (Cronbach's α = 0.82, α = 0.90, α = 0.86, respectively), perceived susceptibility was measured with two 5-point interval scale items asking participants the

extent to which they thought they were at risk of gaining weight and at risk of becoming obese as a result of drinking soft drinks (1 = *not at all at risk,* 5 = *completely at risk*).

Perceived Severity

At Times 1, 2, 3 (Cronbach's α = 0.89, α = 0.88, α = 0.88), perceived severity was measured with two 5-point interval scale items asking participants how severe they thought the problem of drinking soft drinks is in the context of weight gain and in the context of obesity (1 = *not severe at all*, 5 = *extremely severe*).

Involvement

At Times 1, 2, 3 (Cronbach's α = 0.84, α = 0.88, α = 0.88), involvement was measured with six 5-point interval scale items asking participants the extent to which they felt that the issue of drinking soft drinks and gaining weight or becoming obese was involving, personally relevant, and important.

Soft Drink Consumption

Soft drink consumption was measured using the beverage intake questionnaire (Hedrick, Comber, Estabrooks, Savla, & Davy, 2010). The item assessed beverage intake in two parts – frequency and amount. Participants were asked about the number of times a day (1 = *never*, 7 = *more than three times a day*) and how much each time (1 = *less than 6 fl. oz. or ¾ cup*, 5 = *more than 20 fl. oz. or 2½ cups*) they drink water, whole milk, vegetable juice, and regular soft drinks. The frequency and amount were then multiplied to create indices of soft drink consumption at base rate, consumption intentions, and actual consumption. Non-soft drinks were included to reduce demand characteristics and were not analyzed. Baseline measures were collected (Time 1) to control for individual differences in existing soft drink consumption patterns in the ensuing analyses. Consumption intentions (Time 2) assessed how the treatments may have influenced intentions to consume soft drinks in the following week. Finally, consumption (Time 3) assessed actual soft drink intake during the week.

Results

Effect of Exemplification on Risk Perception

Perceived Likelihood

RQ1A inquired about changes in risk perception over time. A repeated measures analysis of covariance (ANCOVA) was conducted with time as the within-subjects factor, exemplification channel as the between-subjects factor, and perceived likelihood at Times 2 and 3 as the within-subjects variable, controlling for perceived likelihood at Time 1. The main effect of time was not significant, $F(1, 58) = .80$, $p = .37$. The interaction effect of time by channel approached significance, $F(2, 58) = 2.61$, $p = .08$, $\eta^2 = .08$. Means (Table 1) indicated that at Time 2, the effect of picture and virtual exemplars resulted in greater perceived likelihood than the effect of base-rate statistics. At Time 3, the effect of the virtual exemplar amplified, resulting in greater perceived likelihood than base-rate statistics or the picture exemplar.

To further investigate differences across conditions, a univariate analysis of variance (ANOVA) was conducted with exemplification channel as the independent variable and perceived likelihood at Time 2 as the dependent variable. The main effect of exemplification channel was not significant, $F(2, 59) = 1.40$, $p = .26$. The virtual exemplar did not yield greater perceived likelihood immediately following treatment than the picture exemplar or base-rate statistics. H1A and H2A were not supported. A second univariate ANOVA was conducted with perceived likelihood at Time 3 as the dependent variable. The main effect of exemplification channel was significant, $F(2, 59) = 5.23$, $p = .01$, $\eta^2 = .15$. At Time 3, the virtual exemplar elicited

Table 1. Descriptive statistics for dependent measures: means (standard deviations)

	Time 1	Time 2 Base-rate	Time 2 Picture exemplar	Time 2 Virtual exemplar	Time 3 Base-rate	Time 3 Picture exemplar	Time 3 Virtual exemplar
Perceived Likelihood	2.23 (1.26)	2.00 (0.86)$_a$	2.18 (0.99)$_a$	2.52 (1.14)$_a$	2.33 (1.10)$_a$	2.00 (0.80)$_a$	2.91 (0.93)$_b$
Perceived Susceptibility	2.39 (1.19)	2.00 (0.89)$_a$	2.20 (0.91)$_a$	2.86 (1.26)$_b$	2.22 (0.97)$_a$	2.23 (0.87)$_a$	2.82 (0.86)$_b$
Perceived Severity	3.10 (0.94)	3.53 (0.88)$_a$	3.70 (0.81)$_a$	3.68 (0.91)$_a$	3.14 (0.80)$_a$	3.55 (0.95)$_a$	3.52 (0.86)$_a$
Involvement	2.23 (0.91)	2.18 (0.77)$_a$	2.45 (0.70)$_a$	2.98 (1.05)$_b$	2.33 (0.97)$_a$	2.18 (0.72)$_a$	2.80 (0.89)$_b$
Baseline Consumption	4.06 (5.71)	–	–	–	–	–	–
Consumption Intentions	–	3.58 (3.86)$_a$	2.34 (2.47)$_a$	3.29 (4.35)$_a$	–	–	–
Consumption	–				3.99 (3.68)$_a$	3.34 (3.81)$_a$	1.89 (3.50)$_b$

Note. Means and standard deviations in each row with no subscript in common are statistically significantly different ($p \leq .05$).

significantly greater perceived likelihood than both base-rate statistics ($p < .01$) and the picture exemplar ($p = .05$).

Perceived Susceptibility

A repeated measures ANCOVA was conducted with time as the within-subjects factor, exemplification channel as the between-subjects factor, and perceived susceptibility at Times 2 and 3 as the within-subjects variable, controlling for perceived susceptibility at Time 1. The main effect of time was not significant, $F(1, 58) = .05$, $p = .82$. The interaction effect of time by channel was also not significant, $F(2, 58) = .54$, $p = .59$. Across all conditions, perceived susceptibility changed little over time.

To further investigate differences across conditions, a univariate ANOVA was conducted with exemplification channel as the independent variable and perceived susceptibility at Time 2 as the dependent variable. The main effect of exemplification channel was significant, $F(2, 59) = 3.86$, $p = .03$, $\eta^2 = .12$. At Time 2, the virtual exemplar elicited greater perceived susceptibility than base-rate statistics ($p = .01$) and the picture exemplar ($p = .04$). H1B and H2B were supported. A second univariate ANOVA was conducted with perceived susceptibility at Time 3 as the dependent variable. The main effect of exemplification channel was significant, $F(2, 59) = 3.09$, $p = .05$, $\eta^2 = .09$. At Time 3, the virtual exemplar elicited greater perceived susceptibility than base-rate statistics ($p = .04$) and the picture exemplar ($p = .03$).

Perceived Severity

A repeated measures ANCOVA was conducted with time as the within-subjects factor, exemplification channel as the between-subjects factor, and perceived severity at Times 2 and 3 as the within-subjects variable, controlling for perceived severity at Time 1. The main effect of time was significant, $F(1, 58) = 4.22$, $p = .04$, $\eta^2 = .07$. Perceived severity decreased over time across all experimental conditions. The interaction effect of time by channel was not significant, $F(2, 58) = .44$, $p = .65$.

To further investigate differences across conditions, a univariate ANOVA was conducted with exemplification channel as the independent variable and perceived severity at Time 2 as the dependent variable. The main effect of exemplification channel was not significant, $F(2, 59) = .24$, $p = .79$. At Time 2, the virtual exemplar did not yield greater perceived severity than the picture exemplar or base-rate statistics. H1C and H2C were not supported. A second univariate ANOVA was conducted with perceived severity at Time 3 as the dependent variable. The main effect of exemplification channel was not significant, $F(2, 59) = 1.30$, $p = .28$.

Effect of Exemplification on Involvement

RQ1B inquired about changes in involvement with the issue of soft drink consumption over time. A repeated measures ANCOVA was conducted with time as the within-subjects factor, exemplification channel as the between-subjects factor, and involvement at Times 2 and 3 as the within-subjects variable, controlling for involvement at Time 1. The main effect of time was significant, $F(1, 58) = .4.26$, $p = .04$, $\eta^2 = .06$. Involvement decreased over time across experimental conditions. The interaction effect of time by channel was not significant, $F(2, 58) = 1.66$, $p = .20$.

To further investigate differences across conditions, a univariate ANOVA was conducted with exemplification channel as the independent variable and involvement at Time 2 as the dependent variable. The main effect of exemplification channel was significant, $F(2, 59) = 4.52$, $p = .01$, $\eta^2 = .13$. At Time 2, the virtual exemplar elicited greater involvement than base-rate statistics ($p < .01$) and the picture exemplar ($p = .04$). H3A and H3B were supported. A second univariate ANOVA was conducted with involvement at Time 3 as the dependent variable. The main effect of exemplification channel approached significance, $F(2, 59) = 3.00$, $p = .06$, $\eta^2 = .09$. At Time 3, the virtual exemplar elicited significantly greater involvement than the picture exemplar ($p = .03$) and marginally greater involvement than base-rate statistics ($p = .10$).

Effect of Exemplification on Soft Drink Consumption

RQ2 inquired about changes in soft drink consumption over time. A univariate ANOVA confirmed that there were no significant differences across conditions in the amount of soft drink normally consumed by participants prior to receiving experimental treatments, $F(2, 59) = 1.71$, $p = .19$, $\eta^2 = .05$. A repeated measures ANCOVA was conducted with time as the within-subjects factor, exemplification channel as the between-subjects factor, and soft drink consumption intentions at Time 2 and soft drink consumption 3 as the within-subjects variable, controlling for baseline soft drink consumption at Time 1. The main effect of time was not significant, $F(1, 58) = .07$, $p = .79$. The interaction effect of time by channel was significant, $F(2, 58) = 3.80$, $p = .03$, $\eta^2 = .12$. Between Times 2 and 3, individuals exposed to base-rate statistics and to the picture exemplar consumed more soft drinks than they had intended, while soft drink consumption among individuals exposed to the virtual exemplar dropped significantly.

To further investigate differences across conditions, a univariate ANCOVA was conducted with exemplification

channel as the independent variable and soft drink consumption intentions at Time 2 as the dependent variable, controlling for existing soft drink consumption habits at Time 1. The main effect of exemplification channel was not significant, $F(2, 58) = 1.56$, $p = .22$. The inclusion of virtual exemplars did not yield greater intentions to reduce soft drink consumption immediately following treatment compared with the use of picture exemplars or base-rate statistics. H4A and H4B were not supported. A second univariate ANCOVA was conducted with soft drink consumption at Time 3 as the dependent variable, controlling for soft drink consumption at Time 1. The main effect of exemplification channel was significant, $F(2, 58) = 4.90$, $p = .01$, $\eta^2 = .14$. At Time 3, the virtual exemplar led to lower soft drink consumption than both base-rate statistics ($p < .01$) and the picture exemplar ($p = .03$).

Underlying Mechanisms of Exemplification Effects – Mediation Pathways

To test the mediating effects of risk perception and involvement on soft drink consumption (RQ3), the variable of exemplification channel was contrast coded following the guidelines by West and colleagues (1996). Based on the results demonstrating that exemplification yields health messages with greater influence than base-rate statistics, a mediation test was conducted to compare the effects of picture (coded -1/2) against virtual exemplars (coded 1/2) independently of the base-rate condition (coded 0). Using the PROCESS macro for SPSS (Hayes, 2012; Model 6) with 5,000 bootstrap samples, four serial mediation tests were conducted to determine the underlying mechanisms between exemplification channels and soft drink consumption.

The first serial mediation test, with perceived susceptibility at Time 2 as the first mediator and consumption intention as the second mediator, revealed that being exposed to the virtual exemplar led to greater perceived susceptibility ($b = 1.21$, $p = .01$) than being exposed to the picture exemplar. Perceived susceptibility then led to greater intentions to consume soft drinks ($b = .59$, $p = .04$), and greater intentions led to greater consumption ($b = .23$, $p = .06$). The indirect effect from exemplification channel to perceived susceptibility, and then to consumption intentions, and finally actual consumption was significant (effect size = .17, 95% CI [.01, .76]). However, the direct effect of virtual exemplars on the reduction of soft drink consumption was much stronger than this indirect effect ($b = -2.71$, $p < .01$).

The second serial mediation test, with perceived likelihood (Time 2) as the first mediator and consumption intention as the second mediator, revealed similar findings. The indirect effect from exemplification channel to perceived likelihood, and then to consumption intentions, and finally actual consumption was significant (effect size = .12, 95% CI [.001, .57]). The third serial mediation test, with perceived severity (Time 2) as the first mediator and consumption intention as the second mediator, revealed that there were no significant indirect effects (effect size = −.01, 95% CI [−.27, .03]). The final serial mediation test, with involvement (Time 2) as the first mediator and consumption intention as the second mediator, similarly revealed there were no significant indirect effects (effect size = .13, 95% CI [−.03, .77]). These results suggest that although the variables of perceived risk, involvement, soft drink consumption intentions, and actual consumption were directly influenced by exposure to virtual exemplars, they did not function as underlying mechanisms driving reduced intake.

Discussion

Despite some inconsistencies in the observed results over time, findings generally supported the potential of virtual exemplars in health promotion campaigns. The potency of virtual exemplars lies in their ability to illustrate future health risks of present health behaviors, without incurring actual physical costs, in a more concrete and salient manner than traditional exemplars or base-rate statistics. The results indicated that compared with picture exemplars or base-rate statistics, virtual exemplars were more effective in eliciting greater perceptions of risk, involvement, and changes in health behavior 1 week following experimental treatments.

Theoretical Contributions and Implications of Virtual Exemplars

Health behavior theories have noted the difficulty of increasing risk perception, mainly because of positive self-biases (e.g., unrealistic optimism, Weinstein, 1980), which encourage individuals to underestimate their susceptibility to health problems and discount the severity. One study attempted four different messaging strategies to reduce positive self-biases and increase perceived health risk but found that none were effective (Weinstein & Klein, 1995). Another found that increasing the number of risk cues in a message can be effective in increasing perceived risk, but only for actions that the reader frequently engages in (Menon, Block, & Ramanthan, 2002). Thus, the barriers to manipulating perceptions of risk are high and have led to the bulk of studies on perceived risk to focus on correlations rather than causal relationships.

The current study contributes empirical evidence to a small, but gradually increasing collection of literature on designing effective health messages to increase the perception of risk. Moreover, this is one of the first to test the novel affordances of virtual exemplars in effectively increasing risk perceptions in the context of a traditional public health campaign. By doing so, these findings make several theoretical contributions to the health communication and persuasion literature.

First, extending earlier work on message effects on risk perception (Rothman & Kiviniemi, 1999), the current study recognizes the importance of exploring not just what is being communicated but also *how* the message is delivered by comparatively investigating different channels of exemplification. A number of studies on risk communication have pointed to the relative success of messages that embed risk information in richer contexts over pure statistical information, such as narratives, personal testimonials, or pictures (Rothman & Kiviniemi, 1999). What these contextual efforts have in common, and perhaps the main reason for their success above abstract statistics, is that the narratives, testimonials, and pictures are all efforts to mimic personal experience. Personal experience and the mental schemas created as a result of direct experience have a much stronger influence on decision making than indirect experience (Hertwing, Barron, Weber, & Erev, 2004) – people tend to believe what they experience over what they are told. The current findings echo these earlier ones by demonstrating that contextualizing risk information is indeed effective in promoting risk avoidance behaviors. Furthermore, virtual simulations are significantly more effective than static pictures and base-rate statistics in providing this context.

Second, the current study independently tested the effect of exemplification channels on three different dimensions of risk perception, presenting a more nuanced examination of how messages promote risk perception than looking at perceived risk as a global variable. Guided by the framework of exemplification theory, this allows for greater insight on how novel affordances of virtual exemplars may influence responses to health messages. One such affordance is the ability of virtual exemplars to provide simulated events with rich sensory cues (e.g., digital rendering, movement, audio). Echoing earlier research, which found that providing more risk cues in a message was effective because it continued to remind readers of the health risk (Menon et al., 2002), more risk cues provided in virtual exemplars through richer sensory information may have assisted in the message being more available in the mind than did picture exemplars or base-rate statistics. The higher cognitive accessibility likely led to greater perceived susceptibility – feeling that one is at greater risk because the risk came to mind more easily.

Third, the persistence of virtual exemplification effects on different dimensions of risk was observed over 1 week in time. Exemplification theory predicts that the effect of imagery-based exemplars that depict health risks or threats may be intense, and the affective response may be stored and recalled for months (Zillmann, 2006). In the current study, the effects of two forms of imagery-based exemplars, picture and virtual, on adopting the promoted health behavior were compared. At Time 2, the only significant difference across conditions was for perceived susceptibility wherein virtual exemplars were more effective than picture exemplars and base-rate statistics. However, at Time 3, virtual exemplars were more effective than picture exemplars and base-rate statistics in eliciting both perceived susceptibility and perceived likelihood. The delayed effect of virtual exemplars observed at Time 3 for perceived likelihood suggests that passing of time may even amplify exemplification effects. Whereas the effects of picture exemplars and base-rate statistics on perceived likelihood remained unchanged, the effects of virtual exemplars increased perceived likelihood over 1 week. A meta-analysis on delayed attitude changes found that messages that yield greater initial impact trigger amplified effects at a delayed time that were not immediately observable (Kumkale & Albarracin, 2004). The delayed effect was also evident for soft drink consumption. At Time 2, there were no observable differences across experimental conditions in the intention to consume soft drinks. However, at Time 3, individuals who were exposed to the virtual exemplar demonstrated a significant decrease in actual consumption of soft drinks.

The delayed effect may be a result of another novel affordance of virtual exemplars, the ability to accelerate the passing of time and the events therein, concretely depicting the cause and effect relationship between risky behaviors and future negative health consequences. Earlier studies on virtual simulations that tested the effect of virtual acceleration of time also found no observable results immediately following exposure, but significant changes 1 week following exposure (Ahn, 2015; Ahn, Bailenson, & Park, 2014). These studies demonstrated that the concrete depiction of future events promotes feelings of imminence and urgency of the risk, that is, renders the risk salient in the individual's mind, as Zillmann (2006) posited. Thinking of perceived likelihood in parallel with the quantification heuristic, this salience of the health risk following exposure to the virtual exemplar may have amplified its perceived likelihood – the more one thought about it, the more likely it may have seemed that negative health consequences were to occur. Then, when individuals made drink choices outside of the laboratory at Time 3, the effect of virtual exemplars likely had more influence than base-rate statistics or picture exemplars.

Perceived severity demonstrated no differences across experimental conditions. Thinking of perceived severity in parallel with the representative heuristic, the degree of concreteness of the health risk information presented appears to have little effect on how well the illustrated example seems to represent the entirety of the risk. An earlier meta-analysis also noted that perceived severity had a smaller effect on health behavior than did perceived likelihood or susceptibility (Brewer et al., 2007). Means indicated that individuals' perception of the extent of harm posed by a health risk is higher than perceived likelihood and susceptibility, and remains high across experimental conditions.

Using virtual exemplars was also effective for increasing involvement with the issue of reducing soft drink consumption both immediately and 1 week after treatment. In addition to intensifying the perception of what health risk and how it could take place, heightening involvement would lead individuals to realize that the health risk could happen to them as well. As heightening risk perception may not be sufficient to elicit actual health behavior change (Leventhal, Kelly, & Leventhal, 1999), increasing involvement and risk perception with virtual exemplars may further assist individuals in overcoming the hurdles to behavior change.

Taken together, these results imply that in order to effectively communicate health risks, particularly in the context of soft drink consumption, a message should be concrete and accessible in the individual's mind over time and focus on targeting perceived likelihood and susceptibility. The perceived severity of a health risk seems difficult to influence with exemplars, or may be high to begin with, resulting in ceiling effects.

Mediation tests revealed that perceived risk and involvement did not drive reduction in soda consumption. The strongest effect in the mediation tests was the direct negative effect between exemplification channel and soft drink consumption. However, this does not necessarily rule out the possibility of alternative mediators. For instance, some health communication theories, such as the extended parallel process model (Witte, 1998), have proposed motivation to avoid health risk as an important driver of health behavior.

Practical Implications

The discourse on exemplification theory has not included virtual simulation as a potential channel of exemplification likely because most virtual simulations have been tested in controlled laboratories with sophisticated technological features. However, the rapid advancement of technology has increased the accessibility and affordability of virtual simulations (Delo, 2014). As a result, virtual simulations may well be incorporated into public health promotion campaigns to present powerful exemplars that illustrate health risks.

The virtual exemplar in the current study is a low immersive application of virtual simulations in that it focuses mainly on the novel affordance of virtually accelerating the depiction of time, and does not incorporate richer layers of sensory features, such as body tracking or stereovision. Given the present lack of infrastructure to implement highly sophisticated virtual simulations in medical settings, the virtual exemplars used here offer a more cost-effective solution that may immediately be incorporated into public health promotion campaigns or physician's offices.

Moreover, because virtual simulations depict health consequences through concrete and realistic depictions, they may help resolve health literacy barriers that prevent some individuals, particularly of underserved populations, from effectively understanding health information. As the Internet is one of the most sought out sources for health information among youth (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005), virtual exemplars may be an effective channel for health messages for this age group.

Limitations and Future Directions

The present findings are promising for incorporating virtual exemplars in health promotion messages, but some questions remain unanswered. One limitation of the study is its natural confound between the manipulated channels of exemplification. Although the exemplars did not add new content, the absolute amount of information might have been affected. For instance, because the virtual exemplar provides a concrete depiction of the information provided, readers may have been able to create a more vivid mental image than reading a health pamphlet with a picture or no exemplar. In the current study, vividness was not explicitly measured. Future work should assess vividness of virtual exemplars as well as their relationship with risk perception and behavior change to clearly identify the underlying mechanisms.

In addition, because social dietary norms influence eating behaviors in young adults and these norms differ between males and females (Baker, Little, & Brownell, 2003), the skewed sex difference in the current sample may have affected the results. Also, although the effect sizes were generally good for social science research, the small sample size may not be sufficient to detect smaller effect sizes that may be meaningful to public health. Future studies should investigate the effect of virtual exemplars across a wider range of populations and with a larger sample for greater generalizability of the results.

Another interesting future question is the potential of using a real human in exemplars. Earlier studies have confirmed that virtual humans are able to elicit the same

person-perception responses triggered by videotaped (Bente, Krämer, Petersen, & de Ruiter, 2001) and actual humans (Schilbach et al., 2006). However, it is also possible that when the virtual human is not sufficiently realistic, virtual exemplars may make some viewers descend into the uncanny valley (Mori, 1970) and feel uncomfortable. In the context of exemplifying negative health consequences, it makes more sense to incorporate virtual humans as it would be unreasonable and unethical to wait until humans experience the physical cost of deteriorating health to document the exemplar. Future studies could compare the effect of real versus virtual humans presented in exemplars in contexts that do not pose harm.

Conclusion

While there is no panacea for a health problem as complex as obesity, the current study presents preliminary, yet encouraging, results for designing powerful health messages with lasting effects. The ever-growing availability of consumer-grade digital devices and freely available software that enable affordable virtual solutions amplify the practical implications and potency of the current findings in a public health context. Informed by interdisciplinary knowledge from the communication, exemplification, and health behavior research, the current findings suggest that virtual exemplars may serve as a cost-effective yet powerfully engaging tool for constructing effective health promotion messages in the ongoing battle against obesity.

References

Ahn, S. J. (2015). Incorporating immersive virtual environments in health promotion campaigns: A construal-level theory approach. *Health Communication, 30*, 545–556.

Ahn, S. J., Bailenson, J. N., & Park, D. (2014). Short- and long-term effects of embodied experiences in immersive virtual environments on environmental locus of control and behavior. *Computers in Human Behavior, 39*, 235–245.

Ahn, S. J., Fox, J., & Hahm, J. (2014). Using virtual doppelgängers to increase personal relevance of health risk communication. *Lecture Notes in Computer Science, 8637*, 1–12.

Ahn, S. J., Johnsen, K., Moore, J., Brown, S., Biersmith, M., & Ball, C. (2016). Using virtual pets to increase fruit and vegetable consumption in children: A technology-assisted social cognitive theory approach. *Cyberpsychology, Behavior, and Social Networking, 19*, 86–92. doi: 10.1089/cyber.2015.0224

Ahn, S. J., Johnsen, K., Robertson, T., Moore, J., Brown, S., Marable, A., & Basu, A. (2015). Using virtual pets to promote physical activity in children: An application of the youth physical activity promotion model. *Journal of Health Communication, 20*, 807–815.

Armor, D. A., & Taylor, S. E. (1998). Situated optimism: Specific outcome expectancies and self-regulation. *Advances in Experimental Social Psychology, 30*, 309–379.

Baker, C. W., Little, T. D., & Brownell, K. D. (2003). Predicting adolescent eating and activity behaviors: The role of social norms and personal agency. *Health Psychology, 22*, 189–198.

Bar-Hillel, M. (1980). The base-rate fallacy in probability judgments. *Acta Psychologica, 44*, 211–233.

Bente, G., Krämer, N. C., Petersen, A., & de Ruiter, J. P. (2001). Computer animated movement and person perception: Methodological advances in nonverbal behavior research. *Journal of Nonverbal Behavior, 25*, 151–166.

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health Psychology, 26*(2), 136–145.

Childers, T. L., & Houston, M. J. (1984). Conditions for a picture-superiority effect on consumer memory. *Journal of Consumer Research, 11*, 643–654.

Cohn, L. D., Marcfarlane, S., Yanez, C., & Imai, W. K. (1995). Risk-perception: Differences between adolescents and adults. *Health Psychology, 14*(3), 217–222.

Delo, C. (2014). Virtual reality: Advertising's next big thing? *Advertising Age*. Retrieved from http://adage.com/article/digital/virtual-reality-advertising-s-big-thing/294328/

Fox, J., & Bailenson, J. N. (2009). Virtual self-modeling: The effects of vicarious reinforcement and identification on exercise behaviors. *Media Psychology, 12*, 1–25.

Gray, N. J., Klein, J. D., Noyce, P. R., Sesselberg, T. S., & Cantrill, J. A. (2005). Health information-seeking behaviour in adolescence: the place of the internet. *Social Science & Medicine (1982), 60*(7), 1467–1478.

Greene, K., & Brinn, L. S. (2003). Messages influencing college women's tanning bed use: Statistical versus narrative evidence format and a self-assessment to increase perceived susceptibility. *Journal of Health Communication, 8*, 443–461.

Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling*. [White paper]. Retrieved from http://www.afhayes.com/public/process2012.pdf

Hedrick, V. E., Comber, D. L., Estabrooks, P. A., Savla, J., & Davy, B. M. (2010). The beverage intake questionnaire: Determining initial validity and reliability. *Journal of the American Dietetic Association, 110*(8), 1227–1232.

Hertwing, R., Barron, G., Weber, E. U., & Erev, I. (2004). Decision from experience and the effect of rare events. *Psychological Science, 15*, 534–539.

Hu, F. B., & Malik, V. S. (2010). Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. *Physiology & Behavior, 100*(1), 47–54.

Johnson, R. K., Appel, L. J., Brands, M., Howard, B. V., Lefevre, M., Lustig, R. H., . . . Wylie-Rosett, J. (2009). Dietary sugars intake and cardiovascular health: A scientific statement from the American Heart Association. *Circulation, 120*(11), 1011–1020.

Kahneman, D. (2001). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist, 58*, 697–720.

Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. *Psychological Review, 80*, 237–251.

Kumkale, G. T., & Albarracin, D. (2004). The sleeper effect in persuasion: A meta-analytic review. *Psychological Bulletin, 130*, 143–172.

Leventhal, H., Kelly, K., & Leventhal, E. A. (1999). Population risk, actual risk, perceived risk, and cancer control: A discussion. *Journal of the National Cancer Institute Monographs, 25*, 81–85.

Leventhal, H., Nerenz, D. R., & Steele, D. J. (1984). Illness representation and coping with health threats. In A. Baum,

S. E. Taylor, & J. E. Singer (Eds.), *Handbook of psychology and health* (pp. 219–252). Hillsdale, NJ: Erlbaum.

Menon, G., Block, L. G., & Ramanthan, S. (2002). We're at as much risk as we are led to believe: Effects of message cues on judgments of health risk. *Journal of Consumer Research, 28*, 533–549.

Mori, M. (1970). The uncanny valley. *Energy, 7*, 33–35.

Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford, UK: Oxford University Press.

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*. New York, NY: Springer-Verlag.

Rothman, A. J., & Kiviniemi, M. T. (1999). Treating people with information: An analysis and review of approaches to communicating health risk information. *Journal of the National Cancer Institute Monographs, 25*, 44–51.

Schilbach, L., Wohlschlaeger, A., Krämer, N. C., Newen, A., Zillews, K., Shah, J. N., . . . Vogeley, K. (2006). Being with virtual others: Neural correlates of social interaction. *Neuropsychologia, 44*, 718–730.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: Action self-efficacy and coping self-efficacy. *Health Psychology, 19*, 487–495.

Uribe, R., Manzur, E., & Hidalgo, P. (2013). Exemplars' impacts in marketing communication campaigns. *Journal of Business Research, 66*(10), 1787–1790.

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39*(5), 806–820.

Weinstein, N. D. (1993). Testing four competing theories of health-protective behavior. *Health Psychology, 12*, 324–333.

Weinstein, N. D., & Klein, W. M. (1995). Resistance of personal risk perceptions to debiasing interventions. *Health Psychology, 14*, 132–140.

West, S. G., Aiken, L. S., & Krull, J. L. (1996). Experimental personality designs: Analyzing categorical by continuous variable interactions. *Journal of Personality, 64*, 1–48.

West, D., Bursac, Z., Quimby, D., Prewitt, E., Spatz, T., Nash, C., . . . Eddings, K. (2006). Self-reported sugar-sweetened beverage intake among college students. *Obesity, 14*(10), 1825–1831.

Witte, K. (1998). Fear as Motivator, Fear as Inhibitor: Using the Extended Parallel Process Model to Explain Fear Appeal Successes and Failures. In P. A. Andersen & L. K. Guerrero (Eds.), *The Handbook of Communication and Emotion: Research, Theory, Applications, and Contexts* (pp. 423–450). San Diego, CA: Academic Press.

Zillmann, D. (1999). Exemplification theory: Judging the whole by some of its parts. *Media Psychology, 1*, 69–94.

Zillmann, D. (2006). Exemplification effects in the promotion of safety and health. *Journal of Communication, 56*(s1), S221–S237.

Zillmann, D., Gibson, R., & Sargent, S. L. (1999). Effects of photographs in news-magazine reports on issue perception. *Media Psychology, 1*, 207–228.

Received July 14, 2015
Revision received December 31, 2015
Accepted January 4, 2016
Published online August 26, 2016

Sun Joo (Grace) Ahn
Department of Advertising and Public Relations
University of Georgia
Athens, GA, 30602-3018
USA
sjahn@uga.edu

Sun Joo (Grace) Ahn is Assistant Professor of Advertising at Grady College of Journalism & Mass Communication, University of Georgia, and founding director of the Games and Virtual Environments Lab. Her research looks at how virtual experiences through digital devices change the way people think and behave in the physical world.

Appendix

Figure A1. Manipulation pages used in virtual exemplar (left panel) and picture exemplar (right panel) conditions.