

Don't Hurt My Avatar: The Use and Potential of Digital Self-Representation in Risk Communication

Perry Parks
Michigan State
University
parksp@msu.edu

Rosanna Cruz
University of Georgia
rosannac@uga.edu

Sun Joo (Grace) Ahn
University of Georgia
sjahn@uga.edu

Abstract

Persuasive messages are stronger if they are personally relevant to the audience, and over the decades, risk communicators have shaped risk messages to make them as personal as technology has allowed. Personalization began with crude market segmentation, which developed into algorithm-based computer message tailoring based on the illusion of self-representation. With the development of digital avatars and virtual environments, technology has allowed communicators to truly personalize risk messages by immersing individuals into situations where the risks, and their consequences, are manifest. Avatars personalize risk by simulating harm to digital representations with which people directly identify, making future consequences appear imminent by realistically speeding up time, and transforming attitude and intention into behavioral change through effects in which people carry the characteristics and actions of their avatars into the physical world. This paper traces the history of risk communication through self-representation, outlines uses and the potential of avatars in risk communication, and suggests possibilities for digital self-representation in robots. Limitations and ethical implications of digital self-representation are discussed.

Keywords: Avatars, Risk Communication, Virtual Reality

1. Introduction

A young woman questioning her dietary habits hears fat splat onto a scale and sees herself gain weight in accelerated time as she drinks a can of soda every day for two years. A man indifferent to the environment feels the pull of a chainsaw and listens as the blade eats through a tree trunk, then hears the tree thud on the ground. An adolescent creates a digital image of the person s/he wants to be and becomes motivated to exercise to come closer to reaching that ideal. These are all virtual experiences that people have lived via digital worlds through virtual self-representations known as *avatars* [1], and those experiences have changed people's attitudes and behaviors toward aspects of their lives including their diet [2], climate change [3, 4], exercise [5], personal finance [6], and numerous other personal and environmental risk factors. Effective risk communication accurately conveys the presence, type, and degree of danger people may face while simultaneously helping them to appropriately manage their perception of, and individual behavioral responses to, risks [7]. The most effective risk communication incorporates highly personal components because research has shown that people respond positively to risks they feel susceptible to and can do something about [8].

To this extent, using photorealistic avatars to represent the self in a virtual world to deliver a risk message may be one of the most advanced forms of involving highly personal components in a message. In the current essay, the term "self-representation" is defined broadly to trace the evolution of messaging efforts that aim to influence individuals by tailoring and personalizing messages based on people's traits and/or shared characteristics. This essay reviews the origins of self-representation in communication and follows the scholarly and technical evolution of self-representation in risk communication, particularly the use of digital avatars in online or virtual environments. We discuss how message tailoring in risk communication relates to two seminal theoretical frameworks in persuasion and behavior change: Petty and Cacioppo's *elaboration likelihood model*, which suggests that people will pay more attention to messages that are relevant to them [9], and Bandura's *social cognitive theory*, which, among other predictions, posits that people are more likely to change behavior

if they feel a sense of “self-efficacy,” or perceive high levels of confidence in carrying out specific behaviors, even in the face of challenges [10].

Using digital devices to create virtual simulations that vividly portray future consequences of present choices, avatars may be used to increase the personal relevancy of risk communication scenarios by placing individuals in health, safety, or other risk environments and having them witness the consequences of their choices. With the ability to transcend spatial and temporal boundaries by placing people directly in risky situations to virtually experience potential long-term effects, avatars can help solve three major challenges of risk communication: the personalization of risk [11], the demonstration of the imminence of risk, and the transformation of risk knowledge and attitude into real-world behavioral changes. Technology enabling these interventions is becoming increasingly sophisticated, available, and affordable, and therefore increasingly accessible to general audiences.

2. Origins of self-representation in communication

In the early twentieth century, emerging mass media and improvements in mass production and transportation led to the development of broad markets with standardized products meant for the masses [12]. By the middle of the century, advances in production and information technology allowed for shifts to more diversified products catering to a wide range of consumer tastes [12, 13]. Such product differentiation coincided with a rise in market segmentation, which began the process of targeting persuasive messages to individuals by breaking populations into subgroups to make the product or communication available specifically to members of the target population, in hopes that people would better identify with messages targeted for their group. Emerging self-representation efforts within communication continued by directly targeting some groups in the second person, emphasizing the pronouns “you” and “your” in persuasive messages [14].

Continuing research found that while mass media were good at spreading *knowledge* about new concepts, *persuasion* was usually accomplished at the interpersonal level, with individuals being influenced by opinion leaders or their peers [15]. In other words, it is not just the content of a message, but also the source of a message, that has persuasive power. The more people identify with the source as someone respected by or similar to themselves, the more credible and salient those messages become to target audiences. Therefore, delivering messages through known, trusted, and respected sources became another stage in the move toward self-representation in communication.

Risk communicators began to adopt segmentation and personalization tactics through socially responsible marketing, or non-commercial appeals, intended to encourage healthy or prosocial behaviors [16, 11, 17]. For instance, health researchers applied segmentation strategies in developing countries by identifying four types of health behaviors among the population and then using those behaviors to develop targeted messages [16]. New guides addressing risk-related behaviors, such as quitting smoking, took on “self-help” characteristics to make the risk seem more personal and imminent and to increase people’s self-efficacy for transforming risk knowledge into behavioral change [18].

By the 1990s, many scholars argued that traditional segmenting practices were not sufficiently personalized for risk messages. They noted that differences within segmented groups often were as great as differences between groups, limiting the potential for people to see the personal relevancy of segmented messages [19, 18]. These insights, along with advances in computer technology, led to a new practice of computer tailoring of health messages to individuals [20]. Computer tailoring uses computer-based assessment tools to determine a variety of factors related to individual health behaviors, then compiles pre-prepared messages to deliver the most relevant information for each person’s real-time attitudinal and behavioral state [20]. Studies on the effectiveness of tailoring have shown that tailored health messages are read more and remembered better than traditional messages in areas such as diet and cancer screening [20]. Computer tailoring expands the feasibility of larger-scale message strategies, which are cost- and labor-intensive with traditional means of tailoring, so that more people are able to benefit from such advantages.

Although computer-based tailoring made strides toward compiling messages specific to the needs of the individual, the method lacked affective power and a sense of immediacy. Computer-tailored messages are *personalized*, but they are not quite *personal*. Fortunately, new technologies offered communicators an opportunity to increase the personal relevancy and immediacy of risk messages through more sophisticated forms of tailoring [21]. Advanced computer processing and graphics, enhanced speed and accessibility of the Internet, and emerging virtual reality technology fostered the

creation of photo-realistic representations of the self. In nearly any risk communication scenario, these “avatars” can be used to increase personal relevance, central processing of information, and the likelihood of attitudinal and behavioral change.

3. Avatars - the ultimate tailoring tool

The concept of avatars originated in Sanskrit as a description for Hindu deities who incarnated on earth to help mortals. Applied today, the term can refer to “any form or representation that marks a user’s entity ... [a] name, a voice, a photo, a top hat used in Monopoly” [1]. But the word most recently has come to refer to representations of the self in a digital world – representations so engrossing that they can affect how people see themselves and the world, and even influence how people behave [22]. Perhaps the most common use of digital avatars is in social media, where people select profile images to represent themselves on such services as Facebook and Twitter. People choose images ranging from straightforward portraits to cartoons, words, or symbolic photos to reflect their mood, appearance, or how they want to be perceived at a given time. These images or representations stand as a reflection of people’s physical selves portrayed in a virtual environment.

Because one strength of using avatars in risk messages is the ability to increase the personal relevancy of a risk by visually depicting the self-representation involved in the risk event, a critical driver of avatar effectiveness in risk communication is that users feel a merging of identities between themselves and their digitized representations, to the point where they feel that what happens to their avatar, happens to them. Such an experience has been termed *presence*, the feeling of being somewhere you physically are not [23, 24]. The concept of presence has been applied to traditional media, such as television, in earlier scholarship, and it has been argued that enhanced presence is the primary difference between virtual reality and traditional media experiences [25]. Through presence, avatars have the unique ability to place people in digitally created simulations that are sufficiently realistic to turn abstract risks (the *idea* of gaining ten pounds) into concrete experiences (*watching* oneself gain ten pounds). This effect can have dramatic implications for risk communication because people tend to evaluate risks “in the context of their own lives” [26].

Another advantage of using avatars in risk communication is that individuals may be their own most convincing persuader. For example, when unfamiliar brand names were placed on an avatar’s clothes in a virtual environment, experiment participants preferred the brand *their* avatars were wearing over the brand of another avatar sitting across from them [27]. This phenomenon of associating the self with the message by involving the self’s avatar in the persuasive message is termed “self-endorsing,” a concept that can extend theoretically from persuasive marketing to persuasive risk communication, changing users’ attitudes about the relevance of risks [27]. The seductive power of self-endorsement is evident in the avatar-creation website Mad Men Yourself, in which over one million fans of the cable television show have built avatars based on the show’s stylistic period costumes [28]. For risk communicators, it is not hard to imagine the American Cancer Society creating an avatar website around the Pink Ribbon Campaign or the American Heart Association inviting people to create avatars representing red dress fashion and women’s heart health.

Avatars can help people see themselves in a different light, but they can also help people protect their identity by mediating it through a digital representation [29]. Because users are free to create avatars of any appearance, this digitally rendered anonymity is valuable for people seeking or sharing sensitive information related to risky behaviors such as unprotected sex or drug use. As with computer-based tailoring [30], digital anonymity can improve information gathering for researchers and health providers by motivating survey completion and reducing dishonest or incomplete answers about potentially embarrassing risk-filled behaviors [5]. Candidness is facilitated by the fact that the health care avatars people interact with can be perceived as more trustworthy and less judgmental than their human counterparts [31]. The Centers for Disease Control and Prevention (CDC) recognized the opportunity to interact with people in an anonymous environment in 2006 when the agency set up a booth in the virtual world “Second Life.” The CDC saw the Second Life community as an opportunity to reach people about safe sexual behaviors, healthy eating, and active lifestyles, among other topics, and the agency even held a virtual health fair [32].

4. The avatar advantage in risk communication

Risk communication shares many of the same challenges as the broader communications field: gaining attention from distracted or apathetic audiences, orienting those audiences to a particular message, crafting that message to successfully change attitudes, and motivating people to carry their attitude change through to new behaviors. But relying on messages to elicit behavioral changes, such as safe driving or drug use, presents unique challenges due to the highly personal, habit-driven, and emotional nature of risk and health decisions [11]. Because so many risky behaviors -- smoking, poor diet, tanning, and fossil fuel consumption, to name a few -- have temporally distant consequences, it is difficult to make the threat palpable in a message. And, because the issues are so personal, getting someone to commit to a behavior like exercise, diet change, or energy conservation can be difficult. Avatars and virtual reality environments offer unique and potentially powerful solutions to these risk communication challenges. Through photo-realistic self-representation, avatars can personalize risk in ways that traditional messages cannot. Avatars in immersive sensory environments can make distant threats imminent by accelerating time and simulating future, long-term consequences of present, incremental behavior. And avatars' power to influence people has been shown to last beyond virtual sessions, as people seek to transform what they admire about their virtual selves into real-world behavior [3, 5, 33, 34]. The rest of this section will explore the advantages of using avatars as self-representation in risk communication in greater detail.

4.1. Personalizing risk

Petty and Cacioppo's elaboration likelihood model (ELM) posits that people are more likely to centrally process, or pay close attention to, information if they perceive that information as personally relevant [9]. More specifically, risk communication scholars have shown that, in general, the more vulnerable people feel to a threat, the more likely they are to do something about it [35]. A major goal for risk communicators, then, should be to demonstrate not just that a given risk exists, but that the risk poses a personal threat to the individual receiving the message. The ELM has been used as a basis for health information tailoring, with the expectation that personalized messages would increase attention, comprehension, and likelihood of behavior change [19]. Personalizing health-based messages is important because of the complexity of factors affecting personal behavioral decisions: individuals may be motivated for different reasons to achieve the same change in behavior [20].

Information that pinpoints individual motivators can be more personally relevant and lead to more behavioral change [36]. Before technology made avatars and virtual environments practical, Skinner et al. prepared a video-based "talk show," in which relevant clips were selected and assembled based on inputs from participants trying to quit smoking [20]. The program selected tailored "role models" who had successfully faced cessation challenges relevant to individual participants [20]. The resemblance of the role model can help drive home the point; under Bandura's social cognitive theory, identification with a model increases the chances that a person will try to adopt the appropriate behavior [10]. Avatars advance such tailoring efforts by incorporating the participant as both messenger and subject of the message, with the result that the participant can virtually experience the consequence of a risky behavior and "self-endorse" the resultant persuasive message. The role model is not *similar* to the patient; s/he *is* the patient.

4.2. Making distant threats imminent

Another major challenge particular to risk communication is instilling a sense of urgency to change behaviors that do not lead to immediate harmful consequences. Drinking a soft drink every day for a year can result in ten pounds of weight gain, but the gain is too incremental to give most people pause before popping another top. As Pasick and Wallack [37] note, "[I]mproved health is simply not a high priority for many people. This reduces the level of interest in health messages particularly when competing for attention with advertisements for attractive products in which people are interested and *can see immediate rewards* [emphasis added]." An experimental study addressed the issue of soda intake by creating photorealistic self avatars of the participants then having them watch, in a three-dimensional virtual environment, as their avatar consumed one twelve-ounce can of soda a day as a

digital calendar flipped through two “years,” which took only two minutes in real time [3]. As they drank, fat plopped onto a scale and the avatar grew visibly wider, gaining twenty pounds over the period. In the study, Ahn [2] argued that the concrete image of the self gaining weight would increase the imminence of the perceived risk, and therefore induce behavioral change, based on the construal level theory of psychological distance. The theory posits that people thinking in abstract terms, such as long-term health consequences, will put off decisions, whereas thinking in a concrete frame of mind increases the sense of urgency [38]. The virtual environment translates abstract concepts into concrete experiences.

On a larger scale of risk involving environmental problems, the thoughtless use of paper products results in wasted trees and energy. Grabbing an extra napkin, however, rarely evokes environmental concern. Researchers use avatars to demonstrate the large-scale impacts of small-scale environmental choices. A range of virtual experiences have been developed to help people viscerally understand how various behaviors -- from meat eating to water heating -- increase energy use and ultimately damage the environment. One virtual simulation involves people becoming cows and being led to a slaughterhouse [39]. Another experience has people stuffing virtual lumps of coal into their mouths as they take a virtual shower to get a feel for the amount of energy required to heat the water [40]. These experiences allow people to “prelive” the effects their actions will have on their own bodies and on the world around them [21]. Consequently, using self-representations to allow individuals to vicariously experience the digitally simulated consequences emphasizes the imminence of seemingly distant threats, amplifying the effects of risk communication.

4.3. Transforming knowledge and attitude into behavior

Informing individuals about the possible consequences of risky habits, and changing their attitude about the costs and benefits of those habits, are important parts of the risk communication process. Information and attitude change, however, amount to little if they are not followed by changes in *behavior*. Transferring attitude to action is one of the highest hurdles for risk communicators, because while they can shape messages for target audiences, they cannot act on their behalf. Behavioral changes result from a complex combination of individual, social, and environmental factors [41, 10]. Avatars are uniquely situated to facilitate this transfer from attitude change to behavior change, although results documenting their success remain mixed.

Researchers, for instance, have found that the level of realism versus idealism in people’s digital self-representation can influence the degree of changes in real-world activity following exposure to the virtual simulation [42]. People can design self-representational avatars either in a way that depicts themselves as accurately as possible or in a way that reflects an ideal self. People in a Second Life-based health study who created avatars reflecting their idealized body were more motivated to avoid drinking, smoking, and other unhealthy behaviors [42]. The phenomenon of carrying virtual-world avatar characteristics into real-world behavior has been dubbed “the Proteus effect.” For example, studies have found that people with taller and more attractive avatars performed better within a competitive online community [34]. Those with taller avatars later negotiated more aggressively during part of a face-to-face experiment than participants with shorter avatars, regardless of their height in real life. The Proteus effect is based on the concept that self-perception derives from how one is viewed by others [43]; when using an avatar, one might view oneself from this third-person perspective. Because taller people are perceived to be more aggressive and confident by others, those with taller avatars begin to perceive themselves that way even after returning to the real world.

Avatars can also be a source of vicarious experiences and encourage individuals to model the behaviors of their own virtual self-representations in the real world. As modeling is a strong source of behavioral change [10] avatars may serve as systematic guides to desirable behaviors in risk messages. For example, in health scenarios, people may follow their avatars’ behavioral lead in exercising or eating behaviors [5, 33]. In one study people were more likely to exercise within 24 hours after watching their self-avatars running on a treadmill than people who saw inactive avatars or witnessed someone else’s avatar running [6]. Participants who witnessed their self-avatars consuming sugary drinks and gaining weight in immersive virtual environments reduced their actual soft drink consumption up to a week later [2]. Fox, Bailenson and Ricciardi [44] concluded that watching the virtual self capably performing a health intervention increases psychological and physiological motivation and leads to more pro-health behavioral outcomes.

The transference of behavioral effects from the virtual world into the real world is not limited to personal health; it also extends to broader prosocial issues such as reducing natural resource consumption. Researchers found that people who used a virtual chainsaw to cut down a tree in an immersive environment were more likely to conserve napkins in the real world a few minutes after the experience [3]. There is also anecdotal evidence that the attitude and behavioral change lingers. Researcher Jeremy Bailenson told ClimateWire that participants emailed months later to tell him, “they can't walk down the toilet paper aisle of a store without thinking about the falling tree” [45].

In some cases, risk communication messaging and behavior change can occur simultaneously. Active video games that require gamers to engage in physical activity during game play, such as the Wii Fit, offer health coaching, data tracking, and exercise activities in which users move their bodies to produce corresponding movements with animated on-screen avatars. Active video games can get people moving without thinking about it as they perceive the physical activity as entertainment [46]. Although the games require only limited intensity of physical activity, researchers suggest that they can be a good first step toward engaging sedentary children in physical activity and can also be effective for older people and/or those rehabilitating from injuries [46].

5. Limitations of avatars in risk communication

Just fifteen years after computer-based tailoring of risk communication messages was described to be in its infancy [47], technology has progressed from a delivery system based largely on paper printouts of algorithmically derived personal messages to opportunities for participants to witness themselves enduring the future consequences of poor behavioral choices, or even to virtually experience aspects of those consequences in immersive environments. As we have described above, the power of self-endorsing increases the personal impact of avatar-based communication. Furthermore, the flexibility of virtual environments can imbue far-off consequences with a sense of imminence, and feelings of efficacy or vulnerability experienced in a virtual world can become manifest in real-world behavioral changes. However, even as avatars have taken message tailoring to new and extraordinary levels, limitations and questions remain about the uses and effects of digital self-representation in risk communication.

One of the major limitations of avatars is the investment they require from health communicators, and from participants. Risk communication messaging through digital self-representation requires an institution with the resources and know-how to create the proper environment and a person willing to devote time and effort to developing and deploying an avatar. An irritating invitation can cause people to create a mental block against persuasion and demotivate them from investing time and energy into creating or maintaining an avatar. Just as many people might be turned off by a televised public service announcement about the dangers of smoking, they might avoid games, apps, or other digital scenarios in which they feel the pressure of persuasive messaging. In Ahn's [2] study of sugary beverage consumption, attitude and/or behavior changes were not immediate, but were seen one week after participation in the study. Ahn suggested that one reason for the lack of immediate effects could be that participants recognized and rejected the attempt to persuade them, a phenomenon supported by Friestad and Wright [48].

Therefore, avatars might be used most effectively with people who are actively seeking to change risky behaviors and need social support; and, unlike mass audiences, these people must be addressed individually. Creating an idealized virtual self as a role model could help already motivated people to push themselves harder [6]. Avatars also tend to be more effective for people who are more motivated to join virtual worlds in the first place [22]; people who join virtual worlds to form friendships and work on their avatar's appearance may be trying to escape reality and thus be more likely to experience offline effects from interactions with their avatars. For people who are less interested in their digital identity, or less motivated to change risky behaviors, communication efforts in virtual environments might require more subtle, organic messaging that is less likely to provoke persuasion aversion.

To access risk communication information remotely, technology must be available in the home. Many low-immersive environments, such as Second Life and other avatar-based communities, can be accessed simply through a home computer with a high-speed Internet connection. High-immersive virtual reality technology has not previously been practical or affordable for home use, but that is beginning to change. The popular Microsoft Kinect Xbox console can translate a user's movements to an on-screen avatar without handheld devices such as a joystick or Wii-style wand. Sony has released a

three-dimensional viewer that provides an immersive experience for \$800 [49]. Newer three-dimensional viewer models such as the Oculus Rift are now being sold for as little as \$300. So while accessibility is a current limitation for avatars in risk communication, it may not be for much longer.

The potential for the future ubiquity of avatars and virtual environments, however, raises numerous ethical questions. Is it appropriate to use people's own self-images in persuasive messaging without their consent? The social media network Facebook, for example, at one point allowed advertisers to use people's profile photos in ads served up on their friends' pages [50]. Scenarios have been suggested in which self-representations could be appropriated and manipulated to sell diet pills [49]. Just as in the present media environment, social marketers and risk communicators will have to compete with commercial, profit-driven entities for people's time and attention. What levels of virtual manipulation are appropriate to persuade a teenage girl to drink less sugary soda? Knowing that people's avatar characteristics can influence their real-world behaviors, is it right to distort their virtual appearance to elicit an unconscious response? Is it possible, by virtually harming an avatar, to do psychological harm to its user? Some scholars argue that avatars are an expression of identity and warrant ethical consideration: "Virtual harms constitute real moral harms against real people" [51]. Gaggioli, et al. went so far as to refer to concerns regarding avatar treatment as "safety issues" [52]. One of the key benefits of avatars in risk communication is that they can help people realistically experience future harms caused by unproductive behaviors [1]; if those virtual harms can lead to actual harms, the risks and benefits of immersive environments will have to be weighed.

6. New frontiers for self-representation in risk communication

Scholars are still in the early stages of understanding the possibilities and endurance of behavioral effects resulting from risk communication through avatars and digital environments. Avatars raise a complex litany of theoretical and practical questions. Because avatars and virtual environments combine elements of so many areas of study -- computer science, psychology, artificial intelligence, communication and risk communication theory, and health and medicine among them -- many scholars have called for an interdisciplinary approach to future study [21, 52].

Among critical issues identified for health communication are ways of enhancing the visual and behavioral realism of avatars and improving communication between virtual agents and human patients, requiring cooperation across technical and social science fields [52]. Ahn, Fox, and Bailenson [1] credit the rapid advance of avatar research to the combination of psychology theory with digital precision to improve the behavioral realism of avatars and thus the immersive power of virtual experiences. They argue that such work across disciplines will be necessary to continue building knowledge about virtual humans.

One likely future direction of digital self-representation in risk communication will be the increased use of avatars via mobile devices. Already, many virtual environments that are accessible through desktop computers can also be experienced on tablets and smartphones, though often with less functionality and lower user satisfaction, but those gaps will likely be narrowed in the coming years. Active video games, as well, will likely become more common on mobile devices [46]. Transitioning virtual technology to mobile devices will help solve accessibility issues, as global cell phone penetration will approach 96 percent by the end of 2014 [53]. Companies have already introduced mobile applications offering a limited range of pre-designed avatar choices to help people track their health behaviors. Samsung, for instance, released the S Health Buddy for Korean users in 2013, which keeps track of caloric balance based on people's height, weight, and eating and exercise habits [54]. Researchers have also developed a mobile virtual reality program to extend relaxation and biofeedback therapies for people with anxiety disorders [55]. As researchers note, the great advantage of mobile devices is to be able to reach people wherever they are, thus increasing interaction frequency [56].

Because multiple information sources, such as mobile and digital, ensure broader and deeper message reach [26], avatars will also add diversity to the risk communicator's toolbox, possibly extending message delivery to younger people who may not be accessible through traditional media. Many contemporary teenagers, for instance, might be unlikely to read a newspaper or sit through television commercials, but could be enticed to participate in personalized messaging that makes use of their social media avatars or in-game characters.

Finally, the next phase of digital self-representation in risk communication could be an embodied extension of the self: an avatar housed in a robot. Lee et al. [57] propose robots as a tool for mediating

communication among separated family members: hospitalized loved ones, grandparents in other states, traveling parents, etc. The physical presence of a semi-autonomous robot, they suggest, can allow for more intimate interactions such as reading to a child remotely, but also pointing to pictures in the book that the child is holding. Lee et al. also see potential for robots in distance education, likening the robot's physical presence to the experience children get through the Reading with Rover program in which early readers demonstrate less anxiety when practicing with animals than with adults [57]. The leap from these examples to risk-communication scenarios is short. Virtual consultations with health providers, remote but physical check-ins with behavior-monitoring programs, physiological assessments, role-playing, and many more opportunities are possible. Similar to avatars in virtual environments, Lee et al. write, the communicative value robots provide is an even higher sense of presence [57]. To accomplish this presence, they propose design elements necessary to make robot avatars effective for communication including, ease of operability, naturalistic interactions, and thorough feedback for the remote operator. Their own prototypical version of such a device is the Huggable, which is teddy bear on the outside, robot avatar on the inside.

7. Conclusion

Communicators in general and risk communicators in particular have long recognized that persuasive messages are stronger if they are personally relevant and engaging to the targeted audience. Practical realization of this knowledge began with simple attempts to segment audiences based on demographic factors. With the advance of theory and technology, communicators developed more sophisticated methods to help first groups, and then individuals, see themselves represented in a message. This tailoring was originally based on the *illusion* of self-representation, as risk communication materials such as health interventions were crafted to correspond with individuals' volunteered attitude and behavioral information. But with the development of digital avatars and virtual environments, technology has allowed communicators to truly personalize risk messages by immersing individuals into situations where the risks, and their consequences, are manifest.

Avatars offer communicators the advantages of personalizing risk by simulating harm to digital representations with which people directly identify, making future consequences appear imminent by realistically speeding up time, and transforming attitude and intention into behavioral change through effects in which people carry the characteristics and actions of their avatars into the physical world. But avatars also have limitations: the need for buy-in and time investment by both message creators and recipients, the cost and knowledge required to launch and maintain realistic virtual environments, and limited access to immersive technology. All of these limitations are likely to decrease in significance as technology advances -- expanding the general public's access to, familiarity with, and use of immersive self-representations. As avatars become more ingrained in the culture, and perhaps become embodied through robotics, ethical questions will arise regarding treatment of people's digital self-representations: Is it okay to manipulate or alter them without people's knowledge or permission? Does harming an avatar constitute harm to the self? In the coming years, researchers and communicators across multiple disciplines, along with avatar-using individuals, will determine the direction, uses, and rules of engagement regarding risk communication and digital self-representation.

8. Acknowledgements

The authors would like to express their thanks to Glen Nowak, Ph. D., for his valuable feedback and suggestions during the writing of this essay.

9. References

- [1] Ahn, S.J., Fox, J., & Bailenson, J., "Avatars", Leadership in science and technology: A reference handbook, SAGE Publications, Inc., 2012.
- [2] Ahn, S.J., "Incorporating immersive virtual environments in health promotion campaigns: A construal level theory approach", in press, Health Communication.
- [3] Ahn, S.J., "Embodied experiences in immersive virtual environments: Effects on pro-environmental attitude and behavior", Stanford University, 2011.

- [4] Ahn, S.J., Fox, J., Dale, K.R., & Avant, J.A., "Framing virtual experiences: Effects on environmental efficacy and behavior over time", in press, *Communication Research*.
- [5] Dean, E., Cook, S., Keating, M., Murphy, J. Does this avatar make me look fat? Obesity and interviewing in Second Life. *Journal For Virtual Worlds Research*, 2(2), 3-11.
- [6] Fox, J., & Bailenson, J.N., "The use of doppelgängers to promote health and behavior change", *CyberPsychology, Training & Rehabilitation*, vol. 3, no. 2, pp. 16-17, 2010.
- [7] Plough, A., & Krinsky, S., "The Emergence of Risk Communication Studies: Social and Political Context", *Science, Technology, & Human Values*, Sage Publications, Inc., vol. 12, no. ¾, pp. 4-10, 1987.
- [8] Witte, K., "Putting the fear back into fear appeals: The extended parallel process model", *Communications Monographs*, Routledge, vol. 59, no. 4, pp. 329-329, 1992.
- [9] Petty, R.E., & Cacioppo, J.T., "The elaboration likelihood model of persuasion", *Communication and Persuasion*, pp. 1-24, 1986.
- [10] Bandura, A., "Social cognitive theory", In R. Vasta (Ed.), *Annals of Child Development*, 1976.
- [11] Bloom, P.N., & Novelli, W.D., "Problems and challenges in social marketing", *Journal of Marketing*, vol. 45, no. 2, pp. 79-88, 1981.
- [12] Frank, R.E., Massy, W.F., & Wind, Y., "Market segmentation", Prentice Hall, 1972.
- [13] Smith, W.R., "Product differentiation and market segmentation as alternative marketing strategies", *The Journal of Marketing*, vol. 21, no. 1, pp. 3-8, 1956.
- [14] Bruno, S.J., "The effects of personality traits on the perception of written mass communication", *The Journal of Business Communication*, vol. 9, no. 2, pp. 25-38, 1972.
- [15] Rogers, E.M., "Diffusion of innovations", Simon and Schuster, 1962.
- [16] Zaltman, G., & Vertinsky, I., "Health service marketing: A suggested model", *Journal of Marketing*, vol. 35, no. 3, pp. 19-27, 1971.
- [17] Lefebvre, R.C., & Flora, J.A., "Social marketing and public health intervention", *Health Education Quarterly*, John Wiley & Sons, vol. 15, no. 3, 1988.
- [18] Strecher, V.J., Rimer, B.K., & Monaco, K.D., "Development of a new self-help guide—Freedom from smoking® for you and your family", *Health Education & Behavior*, vol. 16, no. 1, pp. 101-112, 1989.
- [19] Kreuter, M.W., Strecher, V.J., & Glassman, B., "One size does not fit all: The case for tailoring print materials", *The Society of Behavioral Medicine*, vol. 21, no. 4, pp. 276-283, 1999.
- [20] Skinner, C.S., Siegfried, J.C., Kegler, M.C., & Stretcher, V.J., "The potential of computers in patient education", *Patient Education and Counseling*, Elsevier Scientific Publishers Ireland Ltd., vol. 22, no. 1, pp. 27-34, 1993.
- [21] Abrams, D.B., Mills, S., & Bulger, D., "Challenges and future directions for tailored communication research", *Annals of Behavioral Medicine*, vol. 21, no. 4, pp. 299-306, 1999.
- [22] Behm-Morawitz, E., "Mirrored selves: The influence of self presence in a virtual world on health, appearance, and well-being", *Computers in Human Behavior*, Elsevier Ltd., vol. 29, no. 1, pp. 119-128, 2013.
- [23] Lee, K.M., "Presence, explicated", *Communication Theory*, vol. 14, no. 1, pp. 27-50, 2004.
- [24] Freeman, J., Avons, S.E., Pearson, D.E., & IJsselsteijn, W.A., "Effects of sensory information and prior experience on direct subjective ratings of presence", *Presence: Teleoperators & Virtual Environments*, vol. 8, no. 1, 1-13, 1999.
- [25] Biocca, F., "The Cyborg's Dilemma: Progressive Embodiment in Virtual Environments", *Journal of Computer-Mediated Communication*, vol. 3, no. 2, 1997.
- [26] Holmes, J., Henrich, B., Hancock, S., & Lestou, V., "Communicating with the public during health crises: Experts' experiences and opinions", *Journal of Risk Research*, Routledge, vol. 12, no. 6, pp. 793-807, 2009.
- [27] Ahn, S.J., & Bailenson, J., "Self-endorsing versus other-endorsing in virtual environments", *Journal of Advertising*, Routledge, vol. 40, no. 2, pp. 93-106, 2011.
- [28] Maher, R., "Two examples of "private-label media" success stories", *Business Insider*, <http://www.businessinsider.com/visual-examples-owned-platforms-success-stories-2009-10>
- [29] Morie, J.F., & Chance, E., "Extending the reach of health care for obesity and diabetes using virtual worlds", *Journal of Diabetes Science and Technology*, vol. 5, no. 2, pp. 272-276, 2011.

- [30] Rimal, R.N., & Adkins, A., "Using computers to narrowcast health messages: The role of audience segmentation, targeting, and tailoring in health promotion", *Handbook of Health Communication*, Lawrence Erlbaum Associates Publishers, pp. 497-513, 2003.
- [31] Leber, J., "The avatar will see you now", *MIT Technology Review*, pp. 22-23, 2013.
- [32] Weinrich, N., "The CDC's second life", <http://blog.social-marketing.com/2006/11/cdcs-second-life.html>, Spare Change, 2006.
- [33] Fox, J., Bailenson, J., & Binney, J., "Virtual experiences, physical behaviors: The effect of presence on imitation of an eating avatar", *Presence: Teleoperators and Virtual Environments*, vol. 18, no. 4, pp. 294-303, 2009.
- [34] Yee, N., Bailenson, J.N., & Duchenaus, N., "The Proteus effect implications of transformed digital self-representation on online and offline behavior", *Communication Research*, Sage, vol. 36, no. 2, pp. 285-312, 2009.
- [35] McKinley, C.J., "Investigating the influence of threat appraisals and social support on healthy eating behavior and drive for thinness", *Health Communication*, Routledge, vol. 24, pp. 735-745, 2009.
- [36] Dijkstra, A., De Vries, H., & Roijackers, J., "Long-term effectiveness of computer-generated tailored feedback in smoking cessation", *Health Education Research*, Oxford University Press, vol. 13, no. 2, pp. 207-214, 1998.
- [37] Pasick, R.J., & Wallack, L., "Mass media in health promotion: A compilation of expert opinion", *International Quarterly Of Community Health Education*, Baywood Publishing Co., Inc., vol. 9, no. 2, pp. 89-110, 1989.
- [38] Lieberman, N., & Trope, Y., "The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory", *Journal of Personality and Social Psychology*, vol. 75, no. 1, pp. 5, 1998.
- [39] Stanford University Virtual Human Interaction Lab, unpublished research, <http://vhil.stanford.edu/>.
- [40] Bailey, J., Bailenson, J.N., Flora, J.A., Arnel, K.C., Voelker, D., & Reeves, B., "The impact of vivid and personal messages on energy savings behavior", *International Communication's 64th Annual Conference*, Seattle, Washington, (to be presented May 2014).
- [41] Fishbein, M., & Ajzen, I., "The influence of attitudes on behavior", *The Handbook of Attitudes*, pp. 173-222, 2005.
- [42] Kim, Y., & Sundar, S.S., "Visualizing ideal self vs. actual self through avatars: Impact on preventive health outcomes", *Computers in Human Behavior*, Elsevier, vol. 28, pp. 1356-1364, 2012.
- [43] Bem, D. J., "Self-Perception Theory. *Advances in Experimental Social Psychology*", vol. 6, pp. 1-62, <http://healthyinfluence.com/wordpress/wp-content/uploads/2011/05/SP-Theory-Bem-Advances.pdf>, 1972.
- [44] Fox, J., Bailenson, J.N., & Ricciardi, T., "Physiological responses to virtual selves and virtual others", *Journal of CyberTherapy & Rehabilitation*, vol. 5, no. 1, pp. 69-72, 2012.
- [45] Mulhern, A., "If you know how a cow feels, will you eat less meat?", <http://www.scientificamerican.com/article.cfm?id=if-you-know-how-cow-feels-will-you-eat-less-meat>, *Scientific American*, 2013.
- [46] Peng, W., Crouse, J., & Lin, J.-H., "Using active video games for physical activity promotion: A systematic review of the current state of research", *Health Education & Behavior*, Sage, vol. 40, no. 2, pp. 171-192, 2012.
- [47] Dijkstra, A., De Vries, H., & Roijackers, J., "Targeting smokers with low readiness to change with tailored and nontailored self-help materials", *Preventive Medicine*, vol. 28, no. 2, pp. 203-211, 1999.
- [48] Friestad, M., & Wright, P., "The persuasion knowledge model: How people cope with persuasion attempts", *Journal of Consumer Research*, pp. 1-31, 1994.
- [49] Bieber, C., "Avatars help shift real-world habits", *New Scientist*, vol. 213, no. 2855, pp. 24-25, 2012.
- [50] Wagner, K., "How Facebook is using your photos in ads", <http://mashable.com/2013/09/05/facebook-ads-photo/>, *Mashable*, 2013.
- [51] Wolfendale, J., "My avatar, my self: Virtual harm and attachment", *Ethics and Information Technology*, vol. 9, no. 2, pp. 111-119, 2007.

- [52] Gaggioli, A., Mantovani, F., Castelnuovo, G., Wiederhold, B., & Riva, G., "Avatars in clinical psychology: A framework for the clinical use of virtual humans", *CyberPsychology & Behavior*, vol. 6 no. 2, pp. 117-125, 2003.
- [53] *The World in 2014 – ICT Facts and Figures*, International Telecommunication Union, pp. 1-8, 2014.
- [54] Lee, M.-J., "Samsung enters crowded market for health apps", <http://blogs.wsj.com/digits/2013/08/22/samsung-enters-crowded-market-for-health-apps>, Wall Street Journal, 2013.
- [55] Repetto, C., Gaggioli, A., Pallavicini, F., Cipresso, P., Raspelli, S., & Riva, G., "Virtual reality and mobile phones in the treatment of generalized anxiety disorders: A phase-2 clinical trial", *Personal And Ubiquitous Computing*, Springer, vol. 17, no. 2, pp. 253-260, 2013.
- [56] Noar, S.M., Harrington, G., Van Stee, S.K., & Aldrich, R.S., "Tailored Health Communications to Change Lifestyle Behaviors", *American Journal of Lifestyle Medicine*, Sage, pp. 112-122, 2011.
- [57] Lee, J. K., Toscano, R. L., Stiehl, W. D., & Breazeal, C., "The design of a semi-autonomous robot avatar for family communication and education", In *Proceedings of the 17th IEEE International Symposium on Robot and Human Interactive Communication*, pp. 166-173, 2008.