Chapter 14
Virtual Doppelgangers: Psychological Effects of Avatars Who Ignore Their Owners

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Imagine a world where multiple versions of yourself exist. These other versions of you may look like you but need not behave like you. Famous authors and screenwriters have depicted this type of scenario multiple times in movies and literary works. For example, in the film *Being John Malkovich,* the actor Malkovich wakes up in a restaurant and looks across the table (Jonze 1999). There is a woman wearing a revealing evening dress, but as his gaze pans up, he is stunned to see his own head on top of the voluptuous female form. Seconds later, a waiter walks by and is also wearing his head. His psychological response is predictably dire, and the terror only increases as he pans across the room and realizes that every single person in the restaurant, ranging from jazz singers to midgets, is wearing his head. He is literally trapped in a room full of identical twins behaving independently of his own intentions and actions. In Edgar Allan Poe's *William Wilson*, the main character William meets another boy who shares his name (Poe 1839). Throughout the story, William's double changes to act and look more like William. William grows frustrated with his double who is constantly mimicking him and giving him unsolicited advice and eventually stabs his double to death. Additionally, in a powerful scene in William Gibson's *Neuromancer* (1984), one of the main characters, Riviera, forces a character named Molly to witness a hologram of herself perform a number of unspeakable acts. Molly's physical self observes the interaction, but she cannot control the actions of the other version of herself.

The above scenarios may seem like situations that would only be possible in science fiction, but if we take a close look at today's digital media, we find that virtual versions of ourselves exist in many different places.

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Doppelgangers

Doppelganger is the term that we will use throughout this chapter to refer to virtual versions of the self. Doppelganger is derived from the German language and is defined as any double or look-alike of a person. Throughout history, several famous individuals have reported seeing their doppelganger. For example, in 1860 as the U.S. presidential election results were rolling in, Abraham Lincoln reported seeing two versions of himself in the reflection of a long piece of glass – one version's face much paler than the other. After sharing this encounter with his wife, she supposedly predicted that the image of the doppelganger signified that Abraham would be elected to a second term as president but that he would not survive the second term (Sandburg 1954).

A loose definition of digital doppelgangers exists in online and video games. In the Massively Multiplayer Online games (MMOs), which are described in a number of chapters in this volume, players get to design the appearance of their avatar that moves through the 3D virtual game. In many of these games, there are very few constraints for avatar creation and with the drag of a slider bar players can control their identity – height, weight, age, and even species.

We also see avatars in traditional console video games. For example, players of the Nintendo Wii can design a virtual representation ("mii") that resembles them on many dimensions (Ratan et al. 2007). The Play Station skateboarding video game, *Tony Hawk's Underground 2 Remix*, also allows players to personalize their avatars by uploading photographs of their own face to the game console (Lum 2005). After the photographs are mapped onto the face of a generic character, players can then control their virtual representation just as any other generic video game character.

In the previous examples, users could create and control avatars that looked like them. However, in many cases, users are not in control of their look-alike avatars; sometimes other players or algorithms take control. This is the case in which avatars become doppelgangers. In the online video game *World of Warcraft* (Morhaime 2009), for example, players' avatars can be "mind-controlled" by other players. In this situation, the player loses all control of his/her personal avatar and must watch for several seconds while his/her avatar is manipulated by another player – often with intentions of sabotage. We also see players' avatars acting autonomously in some sports video games. In hockey and football games, the player can only control one player at a time. When a player relinquishes control of one avatar to take control of another, he/she passes the control of the first avatar to a computer algorithm. The avatar is still part of the player's team, but is autonomously controlled. In another *World of Warcraft* example, some players possess pets that are semi-autonomous avatars. These pets mostly operate under the control of the player, but on occasion the pet will be sent on a mission where it must act autonomously. A computer algorithm guides the behavior of the pet during these missions while the player merely observes (not controls) the pet's behavior. In sum, today's video games allow for character building of characters, which look like the user, and also for algorithms to "take over" the behavior of the user.

In the commercial world, digital doppelgangers can also be designed to look strikingly similar to the self. Through the use of digital photographs and

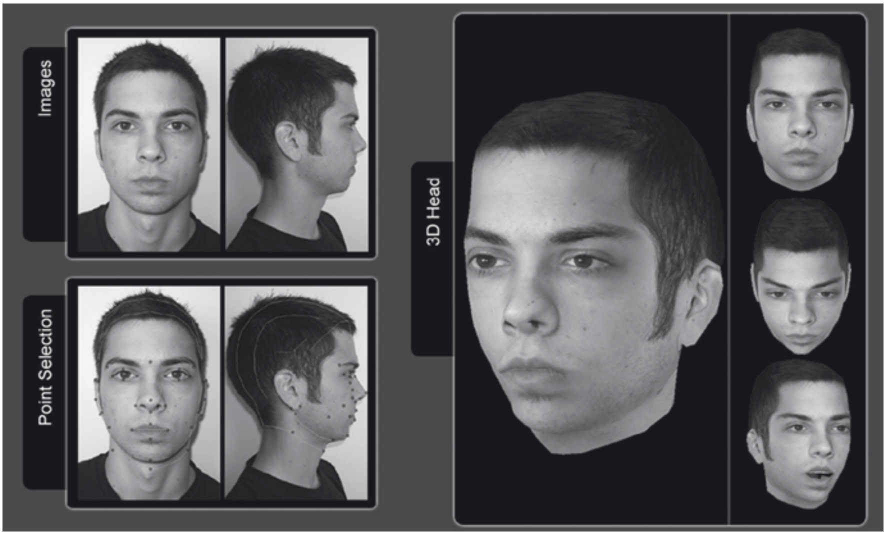

Fig. 14.1 Images and modeling techniques used in creating three-dimensional heads

head-modeling software, an individual's visage may be replicated. In one commercial example, Bruce Willis created multiple versions of himself in the online game *Second Life* to advertise his movie *Die Hard* (Kingdon 2007). In a recent popcorn commercial, an ad agency created a virtual version of the late Orville Redenbacher using old photographs (Advertising Age 2007). The virtual Orville was then portrayed as wearing a slim, new MP3 player – something the real Orville Redenbacher mostly likely had never done in his lifetime.

Scholars in the Virtual Human Interaction Lab at Stanford University have been using similar modeling techniques to create digital doppelgangers for research purposes for the past decade. Figure 14.1 depicts an example of how digital doppelgangers are developed from photographs (Bailenson et al. 2004, 2008). The top left panel shows two photographs of a person, and the bottom left shows the anchor points manually placed on the photographs with photogrammetric software. The right panel shows the resulting 3D head, which is a mesh model with a texture wrapped around it. Although this transference is not flawless, it creates relatively accurate models of the human form.

Theoretical Underpinnings

As doppelgangers that behave autonomously, that is, independent of the users they were modeled after, become increasingly present in new forms of media, scholars in the field need to leverage traditional psychological theories to understand how humans may be affected by the seemingly bizarre concept of being confronted by a virtual version of one's self. Below, we outline several relevant theories from the past 50 years.

Social cognitive theory, originally known as social learning theory, posits that people learn by observing the behavior of models (Bandura 1977, 2001). Several factors, including the similarity of the model, the observer's perceived ability to perform the behavior, and the rewards and punishments associated with that behavior, predict the likelihood of the observer performing the modeled action. In the physical world, it can be quite difficult to find a model that fits all of these factors. However, using digital media we can utilize and manipulate virtual humans, even digital doppelgangers to successfully fulfill these criteria.

Identification has been shown to increase the likelihood of performing learned behaviors (Bandura 2001; Bandura and Huston 1961). Observers must feel that the model is similar enough to them that they are able to experience the same outcomes. Similarity may be based on physical traits, personality variables, or shared beliefs and attitudes (Stotland 1969). Indeed, the likelihood of learning increases when models are of the same sex (Andsager et al. 2006), race (Ito et al. 2008), or skill level (Meichengaum 1971), as well as when models demonstrate similar opinions (Hilmert et al. 2006) or previous behaviors (Andsager et al. 2006).

In creating digital doppelgangers, it goes without saying that social scientists produce models that possess a very high level of physical resemblance to their user. Digital doppelgangers are the richest possible model of the self that we have access to today, and thus they have great potential to serve as powerful models in Bandura's social cognitive theory.

Media richness theory, also known as information richness theory, was developed by Daft and Lengel (1984). In this theory, a medium's richness is generally defined by its ability to reproduce the information sent over it. But more specifically, Daft, Lengel, and Trevino (1987) describe media richness based on four criteria: (1) capacity for immediate feedback, (2) capacity to transmit multiple cues such as graphic symbols or human gestures, (3) language variety, including numbers and natural language, and (4) capacity of the medium to have a personal focus.

Under these criteria, doppelgangers in immersive virtual environments are very rich forms of media. Immersive virtual environment technology (IVET) offers dynamic user-specific viewpoints and a wider field of view than other forms of two-dimensional media (Blascovich et al. 2002). In addition, newer IVET systems are delivering more forms of perceptual detail. Audio technology is being used to produce three-dimensional sound; haptic devices permit virtual touch (Tan et al. 1994), a scent collar emits virtual scent (Nakamoto and Minh 2007), and a haptic interface puts pressure on the tongue to enhance virtual taste (Iwata et al. 2004).

But regardless of whether a user is able to interact with his/her doppelganger in an immersive virtual environment, the personalized avatar is a rich form of media in its own right, as it maximizes more than any other existing medium, the "personal focus" parameter.

The self-referential encoding (SRE) effect states that individuals learn and remember information better when it is related to the self. Rogers and colleagues (1977) proposed that information relating to the self would be remembered and learned better because it would be preferentially encoded and organized above other types of information. In fact, in the original experiment conducted in 1977, Rogers and colleagues found that adjectives were twice as likely to be recalled correctly when they were presented in a self-referential frame (Does this adjective describe you?) versus when they were presented in a semantic frame (Does this adjective mean the same as X?). Furthermore, Symons and Johnson (1997) conducted a meta-analysis involving 129 studies of self-referential encoding effects where they confirmed the expected SRE effect.

In addition, recent functional magnetic resonance imaging work reveals that self-referential information may even be processed using unique structures in the human brain. Heatherton et al. (2004) found that the level of activity in the medial prefrontal cortex during self-referential judgments predicted which items would be remembered by the participant in a surprise memory test. Thus, not only does activity in certain regions of the brain track with self-referential processing, but this activity also contributes to the formation of self-referential memories.

In consideration of the SRE effect literature, the human brain may preferentially process information that our doppelgangers convey to us over information that is presented to us via other humans/avatars. This is an especially important concept when it comes to considering autonomous doppelgangers, as the findings suggest that autonomous avatars that merely look like their users (even if they do not act like their user or share similar beliefs with their user) will activate preferential information encoding.

Self-perception theory (SPT) was developed by psychologist Daryl Bem (1972). SPT posits that humans develop their attitudes by observing their own behavior and concluding what attitudes must have caused them. The theory is somewhat counter-intuitive in that common sense would tell us that attitudes come prior to behaviors, but many studies have produced data that support this theory. For example, several studies have shown that emotions can be derived from behaviors. Such emotions as liking, disliking, happiness, and anger were induced by overt behaviors that had been manipulated by research assistants (Larid 2007).

For example, Frank and Gilovich (1988) conducted a study in which they found that participants who wore black uniforms behaved more aggressively than participants in white uniforms. According to Frank and Gilovich, wearing a black uniform is a behavior that the participants used to infer their own dispositions – "Just as observers see those in black uniforms as tough, mean, and aggressive, so too does the person wearing that uniform" (1988: 83). The participants then adhere to this new identity by behaving more aggressively.

Recently, similar effects have been replicated in digital environments. Merola and colleagues discovered that users given doppelgangers in a black robe expressed a higher desire to commit antisocial behaviors than users given doppelgangers in white robes (Merola et al. 2006). Nick Yee has taken such work one step further and developed a hypothesis that he terms the Proteus Effect (Yee and Bailenson 2007). The Proteus Effect predicts that an individual's behavior conforms to their digital self-representation independent of how others perceive them. For example, subjects who occupy attractive (compared to unattractive or average attractive) avatars behave more socially, and taller avatars negotiate more confidently than shorter avatars. More surprisingly, the confidence from height and socialness from attractiveness extends outside the virtual world to subsequent face-to-face interactions (Yee et al. 2009; Yee and Bailenson Forthcoming). A recent study by Jung and colleagues in 2008 extended this work to show that the same pattern holds for gender; regardless of actual gender, participants embodied by male avatars gestured more masculinely than those in female avatars in terms of interpersonal distance (Jung and McLaughlin 2008). In sum, the self-referencing process does extend to avatars.

Experimenting with Doppelgangers

Now we turn to a number of recent experiments that have explored the question of what happens when individuals are exposed to their autonomous doppelgangers. As we see from the above sections, the notion of seeing oneself from the third person is possible with today's digital media; moreover, existing psychological theory provides predictions for this line of work. We focus on three different research areas: health communication, marketing, and false memories. Figure 14.2 (Panels 2–5) provides screenshots of these various scenarios. Panel 1 on the left shows a participant wearing the head mounted display or HMD (A) where cameras (C) tracked the LED (B) on the user's head to update the scene based on head rotations and translations.

All experiments discussed were run at Stanford's Virtual Human Interaction Lab, and the general research paradigm was similar for all studies reviewed. For an experimental "pretest," all participants visited the lab well in advance of their experimental session, where research assistants photographed the front and profile of the participants' faces. Then, research assistants produced three-dimensional models of each participant's face. When the participants returned to the lab, they interacted

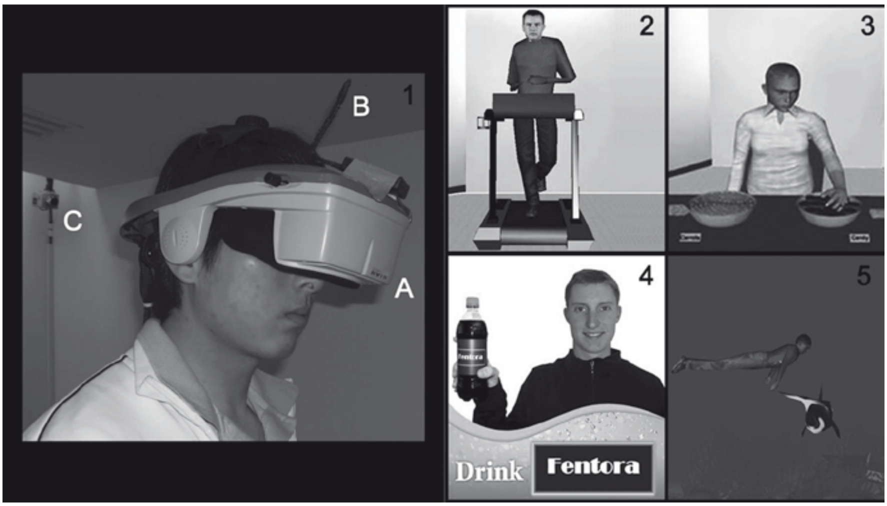

Fig. 14.2 Images from each of the experimental studies

with their digital doppelganger in a virtual environment. We then measured their behavioral, self-report, and memory reactions to their digital doppelganger.

Social cognitive theory is often utilized to understand and design treatments and campaigns for health behavior change. IVET and digital doppelgangers enable novel explorations of health behavior modeling. Over the past three years, Jesse Fox has explored how humans might learn healthy behaviors from their doppelgangers. For example, in one study (Fox and Bailenson 2009), on arriving in the lab, participants were taught a simple arm exercise. Once the participant had successfully learned the exercise, he/she was immersed into one of three virtual environments depending on condition (see Panel 2 of Fig. 14.2).

Participants who were randomly assigned to the *no doppelganger* condition were immersed in an environment that portrayed a small room but no virtual human. Participants assigned to the *changing doppelganger* condition saw their doppelganger from the third person perspective just as participants who were randomly assigned to the unchanging doppelganger condition. However, the changing doppelganger was programmed to gradually gain weight while the participant idled and gradually lose weight while the participant exercised in the physical world. Participants in the *unchanging doppelganger* viewed a doppelganger that remained the same weight regardless of the participant's behavior.

In the virtual environment, participants were instructed to perform three sets of 12 arm exercises. Next, the experimenter instructed them to stand still for two minutes, and finally they were told they could stay in the virtual environment and exercise or could chose to end the experiment. The number of exercise repetitions that the participant completed in the voluntary phase were counted and recorded as the dependent variable.

Data analysis revealed that participants in the changing doppelganger condition completed significantly more voluntary exercises than participants in either the unchanging doppelganger or no doppelganger conditions. These findings suggest that doppelgangers can show the rewards of exercise and can change behavior as a result.

However, it could be the case that any demonstration of cause and effect could cause more exercise behavior (i.e., the virtual representation did not need to look like the self). In a follow-up study, Fox and Bailenson (2009) compared the effects of a doppelganger that looks like the self with a doppelganger of another person. They found that participants who viewed the doppelganger of the self exercised significantly more than those participants who saw the doppelganger of another person. Thus, there is evidence that self-identification is a driving factor behind the results.

In the final study of the series (Fox and Bailenson 2009), participants were exposed to either a doppelganger of the self-running on a treadmill, a doppelganger of another running on a treadmill, or a doppelganger of the self-loitering. Instead of measuring exercise activity immediately following the treatment in the laboratory, participants in this study were asked 24 h later to reflect on their physical activity since the study and complete a standard questionnaire on physical activity. Data analysis revealed that participants in the doppelganger of the self condition performed significantly more exercise than participants in the other two conditions.

In addition to exercise, Fox and colleagues also examined eating behavior (Fox et al. 2009). Participants saw their digital doppelgangers from a third-person perspective eat either chocolate candy or baby carrots for a couple of minutes and then switch to eat from the other bowl of food, as depicted in Panel 3 of Fig. 14.2. After exiting the virtual environment, participants filled out several different questionnaires beside a bowl of chocolate candy. The participants were told that they could eat as many chocolates as they liked while they completed the surveys. Research assistants secretly recorded how many chocolates each participant ate. Of participants who were "high presence," that is, were highly engaged in the simulation, males and females responded differently to the stimulus. Men displayed stereotypical gendered behavior and ate more candy, whereas women also displayed gendered behavior and suppressed the urge to eat and ate less candy.

Self-endorsement, or advertisements that portray potential consumers using products, is a novel marketing strategy of advertising made possible by digital doppelgangers. Self-referential encoding effect has been used to explain the effects of self-endorsement. Ahn and Bailenson (2008) compared the effects of self-endorsement and unfamiliar other endorsement on the viewers of soft drink advertisements.

In the study, two independent variables were manipulated and compared within the context of a soft drink advertisement. Identity served as the first independent variable with two values: self versus other. Medium served as the second independent variable with two values: photo versus text. Creating the photo self-endorsement stimulus involved replacing the celebrity or typical consumer endorser's photograph in an online advertisement with a two-dimensional image of the self's doppelganger. The photo other-endorsement stimulus was created by replacing the celebrity or typical consumer endorser's photograph with a two-dimensional image of the doppelganger of an unfamiliar same sex participant in the study, as depicted in Panel 4 of Fig. 14.2. The text self-endorsement was created by drafting a text ad that used the second person pronoun "you." The same ad was used for the text other-endorsement condition, except that the second-person pronouns were changed to third-person pronouns.

Each participant saw one soft drink ad that was representative of each of the four conditions: self-photo, self-text, other photo, other text. The main effect of identity was statistically significant. The self-endorsement condition evoked more positive ratings of the soft drinks than the other-endorsement condition. In addition, when participants were asked to report which soft drink they felt the highest level of association with, participants reported that they felt the greatest level of association with which ever soft drink was in the photo self-endorsement condition. These findings reveal that photo self-endorsement triggered the highest level of self-referencing when compared with all other conditions. In sum, doppelgangers are powerful marketing agents and can be used in advertisements to create favorable brand impressions among consumers.

In a recent study (Segovia and Bailenson in press), the authors of this chapter explored how human memory could be affected by doppelgangers. We aimed to answer the question of whether doppelgangers could induce false memories in their users and hypothesized that rich media (such as doppelgangers) would be more likely to induce false memories than less rich media.

Approximately 60 pre-school and elementary children visited the lab for two different sessions. In the first session, each child was introduced to a short narrative that described him/her participating in a completely fabricated and implausible event (i.e., swimming with two orca whales). The child was immediately questioned in the baseline interview about his/her memory of the event (i.e., Do you remember swimming with the orca whales?). Next, the child was exposed to one of four different memory prompt conditions: *idle*, *mental imagery*, *doppelganger of another*, *doppelganger of self*. In the idle condition, the child was instructed to sit and wait for a few minutes before the next interview. Children in the mental imagery condition were instructed to imagine swimming with the whales for a few minutes. Children in the doppelganger conditions were immersed in a virtual reality environment where they either saw another child swimming with the orca whales or a virtual representation of themselves swimming with the orca whales, respectively (Panel 5 of Fig. 14.2). Following the treatment, each child was questioned about his/her memory of the event. About 1 week later, all of the children returned to the lab to be interviewed one more time about their memory of the event.

The children's memories were coded based on their completeness ranging from no false memory to a complete false memory (where children actually recalled swimming with the orca whales in the physical world). Data analysis revealed that while the pre-school children were equally likely to form false memories across all memory prompt conditions, elementary children were more likely to form false memories in the mental imagery and doppelganger of the self-conditions when compared with the idle condition. These results give support to our claim that as the media richness of the prompt increases, the more difficult it becomes to distinguish between an actual memory elicited by a physical world event and a false memory elicited by mental image or doppelganger.

We believe that these results are uniquely interesting because they reveal that mental imagery (which must be actively initiated by the participant) and IVET doppelganger of the self-simulations (which can be completely controlled by a third party) are both powerful in eliciting false memories in children. In other words, by viewing an IVET simulation of the self, a passive observer can develop false memories just as easily as a participant using cognitive energy to create mental images. This finding suggests that third parties may be able to elicit false memories without the consent or mental effort of an individual.

Implications and Future Directions

Research on doppelgangers, especially autonomous doppelgangers, highlights several ethical considerations. As can be seen in the Orville Redenbacher example, it is possible for one's digital doppelganger to exist (and be manipulated) long after the physical self has died. One provocative question that arises is who should possess ownership of digital doppelgangers and to what extent are manipulations ethically acceptable? Currently, the artists who construct doppelgangers have nearly unlimited freedom in what animations and edits they create. In the future, some celebrities may wish to add clauses to their legal contracts that forbid or at least restrict the development of digital doppelgangers. On the other hand, other individuals may wish to encourage the development and distribution of their digital doppelgangers in order to further their legacy.

Digital doppelgangers have many practical applications in social psychology and education. For example, digital doppelgangers and IVET may be powerful tools for teaching individuals about the negative impact of their carbon footprints. First, using digital doppelgangers, experimenters and educators can use digital representations of the student to serve as the model. Because of high levels of similarity with the student, digital doppelgangers (as we have shown above) are powerful models. Second, using IVET and digital doppelgangers, educators and researchers can benefit from the ability to transform space, time, and physical laws. Climate change literacy studies would examine the benefits of compressing time to show cumulative environmental damage or making carbon footprints of supermarket products visible. Climate change education is one example, but IVET and digital doppelgangers may be effective tools for educators and social scientists in other topic areas as well.

Autonomous digital doppelgangers are a theoretically and ethically interesting concept. As new media continue to develop and become more personalized, we may face digital doppelganger issues more frequently. These digital representations will help us refine psychological theories and pose interesting questions in their own right.

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