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Avatars and Computer-Mediated Communication: A Review of the Definitions, Uses, and Effects of Digital Representations

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Abstract

Avatars are growing in popularity and present in many interfaces used for computer-mediated communication (CMC) including social media, e-commerce, and education. Communication researchers have been investigating avatars for over twenty years, and an examination of this literature reveals similarities but also notable discrepancies in conceptual definitions. The goal of this review is to provide a general overview of current debates, methodological approaches, and trends in findings. Our review synthesizes previous research in four areas. First, we examine how scholars have conceptualized the term "avatar," identify similarities and differences across these definitions, and recommend that scholars use the term consistently. Next, we review theoretical perspectives relevant to avatar perception (e.g., the computers as social actors framework). Then, we examine avatar characteristics that communicators use to discern the humanity and social potential of an avatar (anthropomorphism, form realism, behavioral realism, and perceived agency) and discuss implications for attributions and communication outcomes. We also review findings on the social categorization of avatars, such as when people apply categories like sex, gender, race, and ethnicity to their evaluations of digital representations. Finally, we examine research on avatar selection and design relevant to communication outcomes. Here, we review both motivations in CMC contexts (such as self-presentation and identity expression) and potential effects (e.g., persuasion). We conclude with a discussion of future directions for avatar research and propose that communication researchers consider avatars not just as a topic of study, but also as a tool for testing theories and understanding critical elements of human communication. Avatar-mediated environments provide researchers with a number of advantageous technological affordances that can enable manipulations that may be difficult or inadvisable to execute in natural environments. We conclude by discussing the use of avatar research to extend communication theory and our understanding of communication processes.

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Keywords: avatars, perception, digital environments, video games, computer-mediated communication, digital representations, social actors, anthropomorphism, human-computer interaction

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Highlights

- The term "avatar" is not consistently defined either operationally or conceptually by researchers in communication.
- In computer-mediated communication, scholars agree that avatars are digital representations of the user in a digital environment.
- The avatar influences perception and attribution of sources and messages in a digital environment.
- The computers as social actors framework and the model of social influence in digital environments lend insight into avatars.
- Perceptions of avatar agency and social potential (e.g., anthropomorphism and behavioral realism) have implications for digital interactions.
- Avatar characteristics afforded by an interface can augment or limit people's ability to self-present and engage in the digital environment.
- Scholars can use avatars in research to facilitate experimental control and the investigation of complex communication processes and theories.

Content

Introduction

When communicating in computer-mediated environments, individuals often rely on some form of *avatar*, or a digital representation that symbolizes the self in the interaction. Depending on the context and definition of the term, these representations may range from a simple screen name or a graphical icon to a lifelike, animated three-dimensional character. Researchers across several disciplines and scholarly traditions have posed questions about the influence of these avatars, both within and outside of the computer-mediated environment.

Users are able to manipulate, control, embody, and interact via avatars in a variety of contexts, which is of interest to communication scholars because these representations can shape computer-mediated communication (CMC) experiences. For example, when users interact in digital environments, they make judgments and attributions based on the names, appearance, and behaviors of others' avatars; further, users' avatars may influence their behaviors in interactions (E. J. Lee, 2007; Nakamura, 2002; Nowak & Rauh, 2005). Whether intended by the sender or not, avatars may also be perceived as messages in and of themselves, such as when individuals use a political symbol as a graphical avatar on a social networking site.

An avatar's characteristics may be determined by several factors, including user preferences, social norms, experiences within the environment, and technological affordances or constraints of the system (Blascovich & Bailenson, 2011; Nowak, 2015; Stromer-Galley & Martey, 2009; Yee, 2014). These characteristics may include appearance, traits, abilities, or behaviors that are reflective of human capacities and norms or complete fantasy. Differences in these representations are notable given that avatars have been shown to influence beliefs, attitudes, and behaviors in a variety of contexts, including interpersonal communication (Kotlyar & Ariely, 2013; Van Der Heide, Schumaker, Peterson, & Jones, 2013; Waddell & Ivory, 2015), health communication (Ahn, 2015; Fox, 2012), group communication (Van Der Land, Schouten, Feldberg, Huysman, & Van Den Hooff, 2015), environmental communication (Ahn, Bostick, Ogle, Nowak, McGillicuddy, & Bailenson, 2016), nonverbal communication (Bente & Krämer, 2011; Hasler & Friedman, 2012), organizational communication (Park & Lee, 2013), and advertising (Ahn & Bailenson, 2011).

Our aim for this article is to provide a broad overview of avatar research in the field of communication. In our literature search, we examined every article including the term "avatar" in its text according to the EBSCO Communication & Mass Media database. Further, we reviewed titles and abstracts in major communication journals based on searches for terms such as "virtual," "computer," and "digital" (e.g., *Journal of Communication*, *Communication Research*, *Human Communication Research*, *Journal of Computer-Mediated Communication*, *Communication Monographs*) to identify potentially relevant articles that may not have used the word "avatar." We also conducted a keyword search for "avatar" in WorldCat and identified several relevant articles written, or often cited by communication scholars. Based on these searches and sifting through references cited within avatar-related papers, we also identified communication scholars who publish research on avatars and identified some of their relevant work published outside of communication, though we maintained our focus their work specific to avatars and communication processes. Although these methods are not perfectly systematic, this use of multiple approaches helped identify a broad range of work of interest to communication scholars. Obviously, we cannot discuss every article uncovered in this process; thus, we identified common themes and focused predominantly on articles relevant to communication processes rather than user experience, human-computer interaction, or psychological effects of avatars independent of a social context (e.g., individual experiences of identification or embodiment).

In this article, we begin with a review of select definitions of the term "avatar," variations in the use of the term in the field of communication, and how those variations influence the ability to replicate results, apply theory, and make meaningful, generalizable conclusions. Next, we provide an overview of the literature on how users select avatars and what is known or hypothesized about the effects of these choices. Then, we review research examining how people perceive and make attributions about avatars in communication contexts. Finally, we conclude with a discussion of how avatars can be used for theory development in communication and pose critical questions for future research.

The Emergence and Definition of Avatars in Communication Research

Before discussing the uses and effects of avatars, we will explore the various conceptualizations of the term *avatar* in the communication literature. Our examination of published articles demonstrates that many researchers use the term *avatar* but do not explicitly define it; others examine what many would consider avatars without using the term; and some scholars employ inconsistent definitions across their body of work. Although it is not uncommon within the social sciences to see conceptual definitions differ across studies, these variations can influence not only the individual study's conclusions, but also the interpretation of results more broadly within the context of communication theories and processes (Chaffee, 1991). The absence of agreement on conceptual definitions, inconsistent operationalization, and appropriate manipulation checks also contribute to the replication crisis discussed by Kahneman (2012) and others. Scientists have had difficulty replicating results even when they are trying to test the same concepts and theories with the same protocols (Open Science Collaboration, 2015). Thus, variations in the use of *avatar* make it difficult for researchers to ascertain the scope of relevant research and complicates the process of replicating findings, leading to further difficulty for those seeking to understand the influence of avatars. We begin our review by identifying several recurring similarities and differences in the conceptualization of the term.

Similarities in Conceptualization

Among articles that discussed the origins of the term, there was agreement that *avatar* originated in Hinduism and is adapted from the Sanskrit word for "descent." In this context, an avatar is human embodiment of a deity or a spirit which allows them to experience earth from the perspective of, or to interact with, humans (Blascovich & Bailenson, 2011; Castronova, 2005; Nowak, 2015). Although there were earlier uses of *avatar* referring to computer-based contexts, Neal Stephenson's (1992) science fiction novel *Snow Crash* is generally credited with popularizing the use of the word to refer to representations in online or digital environments (Blascovich & Bailenson, 2011; Nowak, 2004).

Descriptions of avatars by communication scholars nearly universally acknowledge the avatar as a digital representation (e.g., Biocca, 1997; Blascovich & Bailenson, 2011; Nakamura, 2002; Nowak & Biocca, 2003). The representation serves as a symbol or marker of its associated entity within the digital space. Another commonality across most definitions is that an avatar represents the user in a digital environment (e.g., Kapidzic & Herring, 2011; Klang, 2004; Nakamura, 2002), although there are variations in how scholars label other controllers' representations. Further, most definitions state or imply that the purpose of an avatar is to enable the user to experience and interact within the spaces of digitally mediated worlds (Biocca, 1997; Yee & Bailenson, 2009), and with other users (Meadows, 2007). Although fully interactive digital embodiments provide a more immersive interaction in the digital world, even a simple screen name or static image in an online chat room can facilitate this ability to experience digital worlds and interact with others. Everything from a screen name to a 3D embodiment can give receivers information about others in the environment, help identify who is speaking, and provide cues for conversation regulation and turn-taking (Schroeder, 2002). In virtual worlds and video games, avatars provide a form of embodiment that enables navigation through virtual spaces. In some platforms, avatars can also facilitate more complex actions including nonverbal communication via gestures, body posture, proxemics, and even haptics (Biocca, 1997; Blascovich & Bailenson, 2011). These commonalities provide a foundation outlining the definition of an avatar, though scholars demonstrate disagreement and inconsistency on other aspects of the construct.

Differences in Conceptualization

Across the literature, communication scholars have employed several different conceptualizations of avatars. Here, we focus on three distinctions that seemed most common and consequential. First, many scholars specified a more conservative definition that either explicitly or implicitly required that an avatar have a graphical embodiment or visual presentation. One example is Nakamura (2002), who described an avatar as "a visual digital representation of a self in cyberspace" (p. 153). Several scholars have included this qualification (e.g., Bailenson, Yee, Merget, & Schroeder, 2006; Kim & Sundar, 2012; Martey & Consalvo, 2011; Nowak & Biocca, 2003; Peña, Hancock, & Merola,2009; Schroeder, 2002; Van Der Heide et al., 2013; Webb, 2001). Other researchers adopted a broader definition that

encompassed any form of digital representation and included non-graphical representations such as usernames, sounds, or text-based descriptions (e.g., Chan & Vorderer, 2006; Fox & Ahn, 2013).

Another distinction across conceptual definitions is whether the *agency* or control of the representation is a human in real time or an automated computer program. Some definitions of *avatar* do not make a distinction; for example, Nowak and Rauh (2005) describe avatars as "computer generated visual representations of people or bots" (p. 153). Other scholarship uses the term *agent* to describe a representation whose actions are controlled by a computer, whereas *avatar* is used to describe a representation whose actions are controlled by a human (e.g., Biocca, 1997; Fox, Ahn, Janssen, Yeykelis, Segovia, & Bailenson, 2015; Lim & Reeves, 2010; Nowak & Biocca, 2003). Researchers have theorized that human-controlled representations are more likely to influence users than computer-controlled ones (Blascovich, Loomis, Beall, Swinth, Hoyt, & Bailenson, 2002; Nowak & Biocca, 2003). There is no clear line to be drawn in terms of human and computer control, however. In practice, human-controlled representations rely on computers to control at least some functionality, whether making the human user's typed text appear on a screen or having a video game character execute a sequence of animations based on the human user's keypresses. Although rare, some avatar definitions acknowledge aspects of both human and computer control (e.g., Bente, Rüggenberg, Krämer, & Eschenburg, 2008).

A final notable variation in definitions is tied to the fidelity of avatars in terms of detail, richness, appearance, or ability. Some authors define the avatar in terms of physical realism (how lifelike it appears), behavioral realism (how authentic its actions are), or anthropomorphism (how similar it is to human morphology or behavior; e.g., Nowak, Hamilton, & Hammond, 2009). Early definitions were likely influenced by the particular environments researchers were studying at the time; hence, some definitions include terms like "cartoon" or "two-dimensional" (e.g., Haythornthwaite & Wellman, 2002; Webb, 2001). As technologies evolved, so did definitions. Later definitions refer to avatars as "three-dimensional" (Bailenson, Yee, Blascovich, & Guadagno, 2008) and "animated" (Bente et al., 2008). These more specific definitions are quite limiting, as the nature of an avatar is determined by what a particular computer-mediated platform affords; in essence, these definitions mean that avatars can only exist in certain digital environments but not others. Optimally, both conceptualization and theorizing about avatars would be more generalizable and not constrained to specific platforms.

Conceptualizing Avatar for Future Research

In summary, the most liberal definition of the term *avatar* would entail any representation of any controller. Even in the context of CMC, the types of representations that could be considered an avatar are quite broad: a photograph on a social networking or online dating site profile; a non-playable, computer-controlled agent in a video game; a graphical icon in an online forum or chat; a floating hand in an augmented-reality environment; one's image in a videoconference; a caller's personalized ringtone on a phone; or one's virtual body in an immersive virtual environment. Other definitions would limit avatars to only visual representations, or even more conservatively, to three-dimensional, animated, human-like representations controlled by humans in real time. Each of these different conceptualizations is likely to influence the conclusions researchers make about the effects of avatars.

Based on our review of the research, we believe it is important to set some boundaries for appropriate use of the term *avatar.* To do so, we must acknowledge both historical and ongoing research in this area. We must also consider existing capabilities, modalities, and affordances without being short-sighted and constraining the definition in a way that would exclude potential future computer-mediated interfaces. Thus, we endorse a more open definition and argue that an *avatar* is a digital representation of a human user that facilitates interaction with other users, entities, or the environment. For communication scholars, this definition highlights the communicative potential of avatars.

Perhaps the most common element we noted across existing definitions that we opted not to include in ours was the more restrictive requirement that avatars be "visual" or "graphical." Although current CMC environments may be largely visual—and existing research reflects the prominence of this mode—text-based and auditory representations are not uncommon. We did not want to restrict our definition based on the type of sensory input given the growing richness of many digital environments. A final consideration is that humans vary in their sensory abilities, and some users or platforms may employ non-visual representations to increase accessibility. For example, developers have worked to replace

visual stimuli in digital games with auditory or haptic representations for blind and visually impaired players (Yuan, Folmer, & Harris, 2011). Thus, we opted for a more inclusive scope in our definition.

We acknowledge that our definition is broad, but it is intended to serve as an umbrella term independent of specific platforms or affordances. Researchers are encouraged to employ more specific and precise terms to describe subsets of avatars. For example, the term *embodied avatar* has been used to describe representations that have a bodily form to control via naturally mapped movements (e.g., Groom, Bailenson, & Nass, 2009), and the term *virtual human* is often used to describe highly realistic representations of people in immersive virtual environments (e.g., Blascovich & Bailenson, 2011). Further, what is excluded from our definition indicates that other terms are necessary to describe other types of representations. Our definition is limited to digital representations, which excludes physical entities such as game pieces, sock puppets, or robots. Because our definition necessitates a human user, it implies that other terms should be used to describe computer-controlled entities, bots, and algorithms (e.g., *computer agent*).

Though we are making an argument for this definition, we recognize that not all researchers will agree. Whether researchers adopt our definition or not, it is critical for researchers to clearly and carefully explicate their use of the term. They should also consider how avatars are being conceptualized and operationalized in others' research when framing hypotheses, theorizing, or drawing conclusions from their findings. Such clarity and precision are necessary because existing research demonstrates that these differences are not merely semantic. For example, a meta-analysis revealed that people perceive representations differently when they believe representations are controlled by humans rather than computers (Fox et al., 2015). Researchers must consider the scope and potential boundary conditions of how they conceptualize avatars to promote appropriate generalizing, enable suitable replications, and facilitate theory building.

Avatar Perception: Processing Digital Bodies and People

An avatar allows a person to experience and interact in a digital world. In many ways, the avatar is analogous to the corporeal body. First, it is the digital or corporeal body that allows people to experience the environment. Second, both avatars and corporeal bodies help identify a person and distinguish them from others. Further, both avatars and corporeal bodies are a form of self-presentation and identity expression that provide information to other interactants; this information is used in making social judgments and attributions of others (Ash, 2015; Blascovich & Bailenson, 2011; Guadagno, Blascovich, Bailenson, & McCall, 2007; Hamilton & Nowak, 2010; Lee & Nass, 2002; Nowak et al., 2009).

Likely because of these similarities, people have carried the categories and processing strategies they have developed from a lifetime of off-line experiences with corporeal bodies into their experiences in digital worlds with avatars. This practice is consistent with theoretical perspectives and models such as computers as social actors (CASA, Nass & Moon, 2000; derived from the media equation, Reeves & Nass, 1996), which suggests that humans treat computer generated entities and digital representations as social others. Thus, the off-line person perception process has been shown to help predict online avatar perception with some exceptions, as discussed below.

Perceptions of Avatars: Humanity, Agency, and Social Potential

Among the first judgments made of a representation in a digital environment is determining agency or humanity (Bailenson, Swinth, Hoyt, Persky, Dimov, & Blascovich, 2005; Nowak, 2004; Nowak & Biocca, 2003). People are likely to feel a stronger connection with an avatar with human features at a basic biological level (Sheehan & Sosna, 1991), which leads to the assessment of the social potential of the entity being represented by the avatar (Nass & Moon, 2000; Nowak, 2015).

Information processing theory (McGuire, 1968) provides additional insights into why these assessments of humanity are crucial to understanding avatar perception. According to this theory, people pay more attention to sources that have more dynamism, which makes it more likely they will be perceived to be human and have more social potential (McGuire, 1985). Those with more social potential also activate schema and category assignment that lead to attributions that are traditionally reserved for humans such as intentionality, emotions, or categorizations such as gender or age.

Research has replicated this finding with digital representations: more human-like images were perceived to have greater social potential even with simple, static, two-dimensional avatars (Hamilton & Nowak, 2010; Nowak et al., 2009). The more human-like people perceive avatars to be, the more likely it is that theories and findings from human communication will apply to avatar-based interactions. Thus, understanding the how people perceive the social potential of avatars will help predict communication processes and outcomes in computer-mediated environments.

Across the literature, scholars have focused on three overlapping aspects that influence users' perceptions of the social potential of avatars: agency, anthropomorphism, and realism. Researchers must differentiate perceived agency (whether or not an entity is perceived to be human), anthropomorphism (having human form or behavior), and realism (having accurate form or behavior). Here, we define these concepts and review research relevant to understanding avatars.

Agency. In the modern physical world, there is a clear boundary between human and not human, as there are certain visual characteristics, traits, behaviors, and abilities that are unique to humans (Sheehan & Sosna, 1991). There are not necessarily any visible differences between computer-controlled agents and human-controlled avatars in online interactions. A computer agent may be represented by a human-like image that moves and speaks fluidly, whereas a person's avatar could look like a bison or a stapler with halting speech and unnatural movements. Given there are no clear indicators, users may not always be able to distinguish *agency*, or whether a representation is controlled by a human or a bot (Kim & Sundar, 2012; Nowak, 2004; Nowak & Biocca, 2003).

According to the model of social influence in virtual environments (SIVE; Blascovich & Bailenson, 2011; Blascovich et al., 2002), people try to determine whether the digital representation they are interacting with is a person or a bot. This *perceived agency* influences people's responses in the interaction regardless of who or what is actually controlling the representation. A meta-analysis of studies comparing agents and avatars found that both agency and perceived agency mattered: representations controlled by humans were more persuasive than those controlled by bots, and representations believed to be controlled by humans were more persuasive than those believed to be controlled by bots (Fox et al., 2015). Although the exact mechanism has not yet been clarified, some researchers have found that individuals experience higher levels of physiological arousal when they believe they are interacting with another human compared to when they believe they are interacting with a bot (e.g., Lim & Reeves, 2010; Ravaja, 2009). This higher arousal indicates that at a physiological level, the body is making a distinction between interacting with what it perceives as a human entity compared to an object. Future research using technologies such as EEG or fMRI may provide further insights into variations in physiological response when interacting with human- as opposed to computer-controlled representations.

Anthropomorphism. *Anthropomorphism* is the perception or assignment of human traits or qualities such as mental abilities (Kennedy, 1992), cognitions (Tamir & Zohar, 1991), intentions and emotions (Breazeal, 2003), or behavior (Nass, Lombard, Henriksen, & Steuer, 1995) to entities that may or may not be human. This concept is commonly used in avatar research (e.g., Banks & Bowman, 2016; E. J. Lee, 2010; Nowak & Biocca, 2003; Nowak & Rauh, 2008; Verhagen, Van Nes, Feldberg, & Van Dolen, 2014). Others have incorporated terms such as *humanoid* or *human-like* when discussing anthropomorphic digital representations (e.g., Gong & Nass, 2007; Martey & Consalvo, 2011).

Understanding factors that influence perceived anthropomorphism is critical to the role of avatars because cues to humanity are believed to provide clues to an avatar's social potential (Nass & Moon, 2000; Nowak et al., 2009). One factor that increases perceived anthropomorphism is the extent to which an image has a human-like appearance (Gong & Nass, 2007; Hamilton & Nowak, 2010), which can be called *form anthropomorphism*. Another factor is *behavioral anthropomorphism*, or avatars speaking, moving, or acting in ways that may be expected of humans. These behaviors may include responding appropriately to stimuli, interacting autonomously, displaying intelligence or emotion, or satisfying interaction goals (Breazeal, 2003; Nowak et al., 2009; Reeves & Nass, 1996).

Researchers have investigated how anthropomorphic representations influence communicative outcomes and found that more human-like representations are judged more favorably; people consider them more attractive, credible, and competent (Gong, 2008; Nowak & Rauh, 2005; Nowak et al., 2009; Westerman, Tamborini, & Bowman, 2015). Higher levels of anthropomorphism also lead to higher involvement, social presence, and communication satisfaction (Bailenson et al., 2006; Breazeal, 2003; Kang & Watt, 2013).

People also communicate more naturally with more anthropomorphic avatars (Heyselaar, Hagoort, & Segaert, 2017). Anthropomorphism is also tied to social influence, as more human-like representations can be more persuasive (Gong, 2008; Guadagno et al., 2007). Perceived anthropomorphism is a key determinant of the way information and people are judged, which likely influences the extent to which theories about human-human interaction can apply to avatar-based communication. Thus, researchers should continue to investigate the various ways that avatars can resemble humans, and the avatar features and individual differences that influence perceived anthropomorphism.

Realism. *Realism* is the perception that something could realistically or possibly exist in a non-mediated context (Busselle, 2001; Busselle & Greenberg, 2000). Avatar realism could be assessed on many levels (Bailenson et al., 2006; Nowak et al., 2009). An avatar could be judged on its level of fidelity to what an object would look or move like in the off-line world. This fidelity may include details in appearance; rendering such as shading and depth; fluidness of motion; or the naturalness of auditory cues. For example, an avatar could appear cartoon-like or be photorealistic. Realism could also entail an assessment of whether that representation could exist in the physical world or is complete fantasy. In this way, an avatar of a dog may be seen as more realistic than an avatar of a flying purple dragon.

Some scholars have described avatars' similarity to humans, or having human form, using terms such as *form realism*, *behavioral realism*, *communicative realism*, or simply *avatar realism* (e.g., Bente et al., 2008; Guadagno et al., 2007; Guadagno, Swinth, & Blascovich, 2011; James, Potter, Lee, Kim, Stevenson, & Lang, 2015). We argue that this conceptualization and operationalization would more accurately be considered anthropomorphism because these studies specifically explored determinations and representations of humanity. Researchers should distinguish anthropomorphism from realism because they are distinct judgments with different implications for understanding communication. For example, a person may be represented by a highly accurate and lifelike avatar of a fir tree. Although this avatar is realistic, other users may be less likely to attribute social potential to it—and less likely to attempt to communicate with it—because it is not anthropomorphic.

Digital environments provide researchers with novel ways to manipulate and study the roles of anthropomorphism and realism. For example, virtual environments can equip people with additional limbs (Won, Bailenson, Lee, & Lanier, 2015), allow every receiver to see consistent eye contact from the same source (Bailenson, Beall, Loomis, Blascovich, & Turk, 2005), or make a message source look exactly like the receiver (Bailenson & Segovia, 2010; Fox & Bailenson, 2009a). Such manipulations are not possible outside of digital environments, but all have notable implications for communication. For example, additional body parts provide new opportunities for studying nonverbal communication; augmented gaze and appearance mimicry have clear implications for persuasion. Thus, the ability to manipulate the anthropomorphism and realism of avatars in near-infinite ways may offer new insights into communication.

The uncanny valley. People rate avatars with abnormal or exaggerated features as unpleasant (Seyama & Negayama, 2007) and expect anthropomorphic bodies to be animated authentically (Dalibard, Magnenat-Thalmann, & Thalmann, 2012). The uncanny valley hypothesis (Mori, 1970) suggests that there is a general trend for humans to like things that demonstrate human features. There is a point at which high levels of anthropomorphism, however, evoke negative reactions. When representations are perceived as too human-like, but not yet human, they are perceived as creepy and unsettling. Consistent with this hypothesis, research on virtual human representations has shown that too much anthropomorphism can have negative outcomes in social interactions; if a representation appears too human-like, participants like it less, trust it less, and experience discomfort (Groom, Nass, Chen, Nielsen, Scarborough, & Robles, 2009). Stein and Ohler (2017) also argue that an "uncanny valley of the mind" exists, such that people also have negative reactions when a computer-controlled agent demonstrates a certain level of behavioral anthropomorphism, such as autonomous decision-making.

Some argue that the uncanny valley is triggered not only when digital stimuli have high anthropomorphism alone, but also when there is a mismatch between the level of form and behavioral anthropomorphism, or when levels of realism and anthropomorphism do not match (Bailenson et al., 2005; Hamilton & Nowak, 2010). People anticipate that anthropomorphic avatars have more social potential and expect them to demonstrate intelligence, responsiveness, appropriateness, and sociability (Bailenson, Swinth et al., 2005; Nowak et al., 2009). Participants evaluate avatars who look human (i.e., have high form anthropomorphism) but do not act human

(i.e., have low behavioral anthropomorphism) negatively and consider their communication lower in quality compared to other avatars (Bailenson, Swinth et al., 2005; Hamilton & Nowak, 2010). This failure to meet expected levels of social potential leads to disappointment and negative evaluations, such as lower likeability and credibility (Nowak, 2004; Slater & Steed, 2002).

In summary, further research is needed to identify the extent to which avatars must demonstrate anthropomorphic qualities to accomplish the same communicative outcomes as one would expect in off-line environments, and which qualities allow enhanced or augmented communication outcomes. More research should investigate the individual and interactive roles of perceived agency, anthropomorphism, and realism in avatar-based communication. To complicate this process further, evaluations of anthropomorphism, realism, and social potential are subjective and vary widely across individuals and may be influenced by previous experiences, contextual factors, or other cues provided by the source (Bailenson et al., 2006; Busselle, 2001; Nowak et al., 2009). This complexity makes it difficult to specify what human-like or realistic characteristics have the greatest impact when communicating. In the next section, we will discuss the ways in which avatars are perceived in ways similar to human communicators and the implications of such perceptions for CMC research.

Social Categorization of Avatars

Several theories of social identity and intergroup communication acknowledge that individuals evaluate others as members of various groups (see Gaertner, Dovidio, & Houlette, 2010, for a review). Because avatars are perceived as social entities, humans often engage in similar categorization processes, applying the same heuristics and stereotypes they associate with human members of that category (Nowak et al., 2009). Information processing theory would predict that this categorization is more likely to occur when the avatars are perceived to have more social potential. Continuing to make the same category assignments to avatars that are made of humans, including sex and race, is consistent with predictions of the media equation and CASA (Nass & Moon, 2000; Reeves & Nass, 1996). Here, we review some of the research findings on avatars, social categorization, and intergroup communication in digital environments.

Sex and gender. Determinations of sex, assessed through typically dimorphic biological features, is one of the most common categorizations humans make of others, perhaps due to the evolutionary drive of sexual reproduction. Although some categorizations may be made based on physicality and biological attributes, the sociocultural spectrum of gender is often equally salient. Indeed, people make attributions of sex even when physical or biological information is not available, likely because people believe that sex categorization provides information that is useful in understanding others, predicting behaviors, and identifying appropriate interaction scripts (Lakoff, 1987). Thus, it is unsurprising that attributions of sex and gender have remained salient in computer-mediated contexts (Biocca & Nowak, 2002; Fox, Ralston, Cooper, & Jones, 2015; Nass & Brave, 2005; Reeves & Nass, 1996; Turkle, 1995).

Findings from several studies have supported the hypothesis that the sex and gender stereotypes used to evaluate humans are also applied to computer-mediated representations. For example, people expect gendered avatars to have gendered knowledge. Children have been shown to trust female voices more than male voices on topics such as princesses and makeup, but trust male voices more than female voices on topics such as football and dinosaurs (K. M. Lee, Liao, & Ryu, 2007). Similarly, adults trusted simulated male voices more than female voices on a math tutorial but trusted the simulated female voices more than the male voices in a tutorial on relationships (Reeves & Nass, 1996). Stereotypical attributions also hold when people embody gendered representations. Regardless of their biological sex, participants who were given a male avatar in a virtual environment and competed against two female avatars had a higher performance on a math task compared to those who embodied a female avatar in the presence of male avatars (J. E. R. Lee, Nass, & Bailenson, 2014).

These effects are also observed in naturalistic online settings, such as virtual worlds and video games. Similar to face-to-face contexts, male-male avatar dyads maintain greater interpersonal distance than in male-female or female-female dyads (Yee, Bailenson, Urbanek, Chang, & Merget, 2007), and female avatars are subject to more sexual harassment than male avatars (Behm-Morawitz & Schipper, 2016). Other studies have found that exposure to stereotypical or sexualized representations in digital environments is similar to findings with other media. Stereotypical virtual representations of women evoked more sexism than nonstereotypical

representations (Fox & Bailenson, 2009b). Interacting with sexualized representations has been shown to encourage men and women to perceive women as less intelligent (Behm-Morawitz & Mastro, 2009), make men more tolerant of sexual harassment (Dill, Brown, & Collins, 2008), and increase men's likelihood to sexually harass (Yao, Mahood, & Linz, 2010). Embodying or playing a video game as a sexualized avatar has been associated with self-objectification (Fox, Bailenson, & Tricase, 2013; Fox, Ralston, et al., 2015; Vandenbosch, Driesmans, Trekels, & Eggermont, 2017). Findings on helping behavior are mixed, however. One study found that female avatars are more likely to receive help than male avatars (Lehdonvirta, Nagashima, Lehdonvirta, & Baba, 2012) whereas a second study found differences were based on interactions with the user's sex or the avatar's attractiveness (Waddell & Ivory, 2015).

In some cases, interactants may not be able to make a sex or gender categorization. Users feel more uncertain with androgynous avatars that lack clear indications of gender (Nowak & Rauh, 2005, 2008). It is possible that an inability to make this categorization leads to an undesirable state of uncertainty, particularly in a simulated environment with the absence of a corporeal body. At this time, additional research is needed to understand how people process and interpret androgynous avatars.

Race and ethnicity. As with other categories, people often rely on visual cues to determine race or ethnicity, as they believe this information may help them predict behavior. Making this attribution may indicate perceived social potential given that race would only be relevant for humans. In certain conditions, the perceived race of others' avatars in a digital environment influences perceptions of a message source (Spence, Lachlan, Westerman, & Spates, 2013), perceptions of an interaction partner (Vang & Fox, 2014), or a willingness to disclose one's own race (J. E. R. Lee & Park, 2011; J. E. R. Lee, 2014).

Consistent with CASA, several studies have indicated that users assign avatars to racial categories and apply the same associated stereotypes as they would humans. Dotsch and Wigboldus (2008), for example, found that White participants approaching Black avatars in a digital environment experienced higher physiological arousal (measured through skin conductance) and maintained greater interpersonal distance compared to White participants approaching White avatars. In a virtual world, users were less likely to help a Black avatar requesting assistance than a White avatar (Eastwick & Gardner, 2009). Similarly, in an emergency simulation, White participants were less likely to help Black avatars than White avatars (Gamberini, Chittaro, Spagnolli, & Carlesso, 2015). Some studies have shown that embodying or interacting with Black avatars triggers racial stereotypes (Groom et al., 2009), particularly if the portrayals are stereotypical (Burgess, Dill, Stermer, Burgess, & Brown, 2011; Cicchirillo, 2015).

Alternatively, some studies have shown that the experience of embodying a non-White avatar can reduce racial bias (Behm-Morawitz, Pennell, & Speno, 2016; Maister, Sebanz, Knoblich, & Tsakiris, 2013; Peck, Seinfeld, Aglioti, & Slater, 2013). More research is needed to understand the disparities in these findings, though it seems prosocial outcomes may be more likely when users identify more with their avatar and engage in less structured tasks (Behm-Morawitz et al., 2016; Peck et al., 2013).

Similarity and homophily. Homophily, or perceived visual or psychological similarity to the self, influences perception and attribution in communicative contexts. People respond more positively to and prefer others who are similar to themselves. Similar to outcomes in face-to-face contexts, people prefer more homophilous avatars, which are seen as more credible and likeable (Nowak et al., 2009; Nowak, 2013) as well as more persuasive (Guadagno et al., 2007).

Avatars do not have to resemble the actual self to be persuasive, however; they can also persuade when the user's avatar matches others' avatars. As predicted by the social identity model of deindividuation effects, several studies have shown that when interactants' avatars have common features or feel they belong to the same social categories or groups, this similarity enhances social identity and bolsters positive impressions of partners or teammates (E. J. Lee, 2007). Visually similar representations also promote persuasion and conformity effects (Ahn & Bailenson, 2011; Fox & Bailenson, 2009a; E. J. Lee, 2004, 2007). Combining both similarity to the self and similarity to the other in one's avatar may optimize outcomes. One experiment examined team-similar and self-similar avatars and found that avatars that both resembled the user and matched other teammates' avatars yielded the highest levels of social attraction as well as task performance (Van Der Land et al., 2015).

In summary, the characteristics of avatars influence how receivers interpret sources and their messages. Moreover,

avatar characteristics affect outcomes such as communication satisfaction, social influence, and task performance. Whether examining or manipulating avatars in CMC environments, it is crucial that researchers recognize how users are evaluating these representations. These same factors also influence the avatars people choose to represent themselves.

Avatar Selection as Self-Representation

According to Goffman (1959), people carefully manage how they present themselves to optimize their ability to fulfill social goals. In digital environments, avatars are used for self-presentation, and influence how people evaluate digital bodies as they are considering how and when they may select them as avatars (Nowak & Rauh, 2005; Nowak, 2013). Choosing an avatar in the virtual world is in some ways analogous to the process of choosing an outfit to wear in the physical world, though the selections are contingent on technological limitations rather than the clothes in a person's closet.

Compared to face-to-face settings, digital environments typically present users with greater flexibility and control in modifying their self-presentation. Because CMC environments are often asynchronous and lack cues available in face-to-face settings, users can capitalize on the affordance of editability. This process of *selective self-presentation* allows users to tailor their presence to a particular context or interactant (Walther, 1996). Users make judgments of avatars they encounter as described above, which leads them to select avatars they believe will help them meet interaction goals, which could include revealing or concealing elements of their identity to other users. Here, we review several studies regarding the types of avatars people choose and their motivations for doing so.

Avatars as Identity Expression

People typically have multiple goals when selecting an avatar to represent themselves. One common goal influencing avatar selection is the desire to identify and express the self to others. Many users prefer avatars that accurately represent something about them either physically or psychologically (Kang & Yang, 2006; Nowak & Rauh, 2008; Nowak, 2013). On social networking sites and online dating sites, for example, it is expected that a profile picture is a fairly accurate portrayal of the user. Several studies have also indicated that people choose to convey elements of their social identities in the avatars they select, such as sex, gender, race, or age (e.g., Cheong & Gray, 2011; Gerbaudo, 2015; J. E. R. Lee, 2014; Martey & Consalvo, 2011; Nowak & Rauh, 2008). Alternatively, they may select avatars that depict a more idealized or aspirational version of the self (e.g., Bessière, Seay, & Kiesler, 2007; Lee-Won, Tang, & Kibbe, 2017, Sah, Ratan, Tsai, Peng, & Sarinopoulos, 2016).

Some digital environments make it easy for users to express elements of their identities through their avatars (e.g., users can select an avatar that shows identification in a group or that matches their race or gender) or select an option in their profile (e.g., users can upload pictures of themselves, select their age, race/ethnicity, or other characteristics on online dating sites). People in these systems create avatars that represent them, and some even use these systems to reveal aspects of their true or desired selves that they are uncomfortable or unwilling to present face-to-face (Bargh, McKenna, & Fitzsimons, 2002; Turkle, 1995). Even so, it may not always be possible or desirable to be represented by an avatar that accurately represents the off-line self.

Identity Exploration and Deception

Some users will select avatars that accurately represent something about them, but that inaccurately present other aspects of the self. While this may sometimes be a choice, other times it is not. Some digital environments make it difficult to convey one's identity authentically due to technological constraints or social norms. For example, it can be difficult to portray race or ethnicity due to limitations on avatar options such as skin tones, facial features, or hairstyles (Kafai, Cook, & Fields, 2010; Martey & Consalvo, 2011), or even an absence of avatars with diverse gender or race options (Brock, 2011; Nakamura, 2002). Users may have to choose between accurately presenting their sex and accurately presenting their personality, favorite sport, or other aspects of identity (Nowak, 2013).

Alternatively, users may select avatars to "try on" or explore different identities out of curiosity or to see how it feels to be an "other" (Bessière et al., 2007; Turkle, 1995). Identity exploration via avatars may have some positive benefits, such as individuals self-disclosing to others, building relationships, and gaining self-acceptance of their identity. This experimentation can influence people while in the

environment as well as after the experience has ended (Bargh et al., 2002; Turkle, 1995). Some argue, however, that this practice of *identity tourism* may have negative outcomes. For example, if users embody the avatar of a person of color and enact stereotypically consistent behaviors, they may reinforce negative stereotypes for themselves and the people with whom they interact (Nakamura, 2002).

Other users may select avatars with the intention to conceal elements of their identity. In some cases, this concealment has a protective function. For example, users may adopt avatars that do not resemble them to maintain anonymity in a health support group (Green-Hamann, Eichhorn, & Sherblom, 2011). Choosing an avatar that masks one's gender is not uncommon for women in video games and online virtual worlds (e.g., Huh & Williams, 2010; Martey, Stromer-Galley, Banks, Wu, & Consalvo, 2014); some women report engaging in this behavior to prevent harassment (Fox & Tang, in press). Given nonwhite avatars are often subject to prejudice, people of color may also choose not to disclose their race or ethnicity to avoid being treated in a stereotypical fashion, discriminated against, or harassed (Nakamura, 2009; Yee, 2014). Although targeted individuals may benefit from masking their identities through the avatars they select, there are downsides. Limiting the visibility of women, people of color, and other groups may feed into the illusion that they are not present in these environments and reinforce the default assumption that the vast majority of users are White males (Brock, 2011; J. E. R. Lee, 2014).

Of course, these affordances can be used maliciously: people may select an avatar that does not accurately represent them with the intent to mislead or deceive. For example, someone may choose a deceptive avatar on an online dating site with the intention to "catfish" a target and coerce them into sending money. More commonly, these choices are more self-enhancing than malicious. For example, people often use idealized photographs of themselves on online dating sites that make them appear younger, thinner, and more attractive (Hancock & Toma, 2009). When the person does not resemble their avatar in a face-to-face meeting, however, the other person may be disappointed or angry. Because interactants are often aware of the capacity for misrepresentation online, they often capitalize on other affordances to evaluate senders and their messages (DeAndrea, 2014; Walther & Parks, 2002). In this way, motivated receivers mindfully evaluate provided cues to avoid deception and other negative outcomes. Embodying an avatar that is not an accurate depiction of the self can also influence self-perception, identification, and attitudes, as discussed in the next section.

Effects of Avatar Embodiment

As noted, the flexibility of avatars in many contexts means that a user's self-representation can be modified in meaningful ways that may be dissimilar to the physical self. According to the *Proteus effect*, the user's behavior conforms to the modified self-representation regardless of the true physical self (Yee & Bailenson, 2007, 2009; Yee, Bailenson, & Ducheneaut, 2009). Taking on the characteristics of an avatar may influence how a user communicates both online and off-line. When participants embody attractive avatars in a virtual environment, they disclose more personal information and approach their partner's avatar more closely. When participants embody taller avatars, they are more confident and aggressive when negotiating with another person (Yee & Bailenson, 2007). Research from the Proteus effect paradigm has demonstrated that the attractiveness (Van Der Heide et al., 2013), gender (J. E. R. Lee, Nass, & Bailenson, 2014), race (Ash, 2015), or sexualization (Fox et al., 2013) of one's avatar influences self-perception, attitudes towards others, and behavior. Other research has also provided support for the Proteus effect without explicitly adopting the paradigm. For example, Palomares and Lee (2010) found that participants experienced linguistic assimilation with their avatars. Men and women in avatars that matched their gender used more gender-typical language; when they embodied an avatar of a different gender, they adopted language suited to the avatar's gender. These findings suggest that avatar selection may influence communicative outcomes not only based on the receiver's impression, but also based on the sender's experience.

Priming has been put forth as an alternative explanation for the effects of avatars (e.g., Peña et al., 2009; Peña, 2011). Direct comparisons of the two perspectives, however, favor the Proteus effect (e.g., Ash, 2015; Yee & Bailenson, 2009). In addition, many priming findings in other areas have not held up to replications, casting some doubt on the validity of priming effects (Open Science Collaboration, 2015). As with many effects, it is likely that there are uncovered mechanisms and conditional effects at work. Given small sample sizes, changing technologies, and inconsistent findings, researchers should seek to replicate priming studies, Proteus

effect studies, and any number of other findings regarding avatars.

In summary, the flexibility of avatars in many contexts means that a user's self-representation can be modified in meaningful ways that may be dissimilar to the physical self. Given mixed findings across multiple contexts, researchers should continue to investigate the frequency and rationale people have for selecting avatars that do not accurately represent them. Further, researchers should examine how embodying avatars with dissimilar characteristics influence behavior and attitude change. For communication researchers, it is particularly important to examine interpersonal and contextual elements that may influence the outcomes of various types of embodiment.

Future Directions: Using Avatars to Study Human Communication

Although researchers have varied in their ways of conceptualizing avatars, the lack of a cohesive definition has not prevented research on avatars from having a significant impact on our understanding of certain communication processes both online and off-line. Here, we sifted through communication scholarship to clarify definitional approaches and identify common threads in avatar-based research. Based on our review, we have distilled some recommendations for avatar researchers going forward.

Refining Research on Avatars

Our literature review indicated several directions in which avatar scholars can improve the construction, methods, and reporting of research. First, given the diversity of approaches we identified in our literature search, we recommend that future researchers adopt a universal and consistent definition of the term. Consistent conceptualization and appropriate operationalization are essential for building theory about communicating via avatars and increase the potential for replication of findings across studies. Even if disagreement about a universal definition remains, researchers must provide clear definitions within their publications so that other scholars can assess the applicability of a particular finding and understand the nature of the avatars used in the study. Further, when discussing their results, researchers should evaluate the generalizability of their findings across various types or characteristics of avatars and indicate anticipated boundary conditions.

We also advise researchers to provide considerably more detail in the reporting of their manipulations and methods. In our literature search, far too many studies only provided brief, text-based descriptions of the avatars or their digital environments. Given the nearly infinite possibilities in creating avatars across platforms, it is difficult to accurately replicate a study that only offers vague descriptions such as "a male avatar." Within publications, richer descriptions, figures, or links to online content can help resolve this issue. On a broader scale, more open scientific procedures will ease the burden on other scholars looking to build upon, extend, or replicate existing avatar research. If journals cannot accommodate additional information, supplementary materials (such as avatar stimuli or scripts of interactions) can be shared on researchers' websites or in online repositories.

As the research continues to show the effects of experiences with and as different bodies online, it becomes critical to consider the potential of long-term effects caused by avatar choices. Some studies have included post-experimental measures ranging from 24 hours to a few weeks (e.g., Ahn & Bailenson, 2011; Ahn et al., 2016; Fox & Bailenson, 2009a). Although a handful of studies have collected data on avatar use over time (e.g., Bailenson & Yee, 2006; Yee, Ducheneaut, Yao, & Nelson, 2011), longitudinal experimental research is rare, which limits the ability to understand the long-term effects of interacting with, and as, avatars. In addition to long-term studies, researchers should consider potential effects both within and outside of the digital environment (Yee & Bailenson, 2007). For example, there are considerably different implications for someone who imitates an aggressive avatar within a virtual context (e.g., attacking another player's character in a video game) as opposed to imitating that behavior outside that environment (e.g., becoming physically violent with a sibling). Finally, as illustrated by studies suggesting that embodying Black avatars entrenched racial stereotypes for some White participants (Burgess et al., 2011; Groom et al., 2009), researchers should consider and attempt to illuminate both the intended and unintended effects of avatars (Cho & Salmon, 2007). For example, embodying an attractive avatar may be intended to increase self-esteem, but it may also evoke self-objectification, narcissism, or a beauty bias in judging others' avatars.

Topics for Future Directions for Avatar Research

Topically, our review indicates that avatars present two opportunities for communication scholars: they can serve as a novel context to study how people use virtual worlds, and they can be used as tools to understand existing communicative processes (Fox, Arena, & Bailenson, 2009). Avatars can facilitate new and infinitely flexible ways for individuals interact with others and to self-present, ideally allowing a diversity of presentations that can provide insight into communication processes (Nowak, 2015). How does communication behavior vary when one's self-representation is highly dissimilar to one's physical or psychological self? Is information presented by an avatar more or less useful than the corporeal body in developing an accurate mental model of a person?

As objects of study, it is crucial to investigate many of the distinguishing characteristics of avatars we identified in our review. Within the avatar literature, many studies have shown variation in outcomes based on avatar features such as the degree of human agency, levels of realism, and various types of anthropomorphism (e.g., Bailenson et al., 2006; Kang & Watt, 2013; Nowak & Rauh, 2005; Rosenthal-von der Pütten, Krämer, Gratch, & Kang, 2010; Seyama & Negayama, 2007; Stein & Ohler, 2017). As indicators of humanity and social potential, these features may play a critical role in determining how existing theories of human communication apply when interacting with or via avatars.

Future researchers should also consider how attribution and perceptual processes occur in CMC as compared to face-to-face environments. It is possible that information gleaned from the avatar a person selected for an interaction could provide a more accurate mental model of the person than using their corporeal body. Users consciously choose the avatar they are embodying in many interactions to facilitate their interaction goals (Nowak, 2013). It is likely that this presents a part of themselves they want others to understand and may serve as a type of disclosure, whether intentional or not. Future research can examine how much consideration people give to their avatar, and whether their interaction partners can accurately perceive either the person behind the avatar or what the user intended to portray.

Although many theories characterize computer-mediated channels as having depleted cues, avatars can also benefit users by providing more information to interactants in a digital environment than is available in face to face interactions (i.e., *transformed social interaction*; Bailenson, Beall, et al., 2005). For example, avatars could portray real-time physiological indicators such as heartbeat or pupil dilation so that users could track others' attention or involvement in a conversation. Alternatively, avatars could be used to illustrate past selves, aspirational future selves, or other iterations of the self to provide more information than may be visible in real time. Although these portrayals may have benefits, there are potential downsides: too much discrepancy between the avatar and the current self could backfire, or too much information could create cognitive overload. Future research is needed to parse out what additional information avatars can effectively communicate as well as the positive and negative effects of this information.

Avatars can provide experiences beyond just entertainment, and these interactions may influence off-line interactions and processes. Experience with anthropomorphic others who are not actually human, or non-anthropomorphic others who are human, may influence the meaning of "humanness" as people develop new scripts and categorization schemes for digital others. These experiences may lead people to alter their reliance on avatars in perceiving the entities they represent. It may also influence how people interact. For example, avatars with additional body parts, tails, or color-changing halos provide greater bandwidth for communicating nonverbally and may lead to the development of novel forms of interaction. In this way, avatars are both a novel topic of research and a method for understanding existing communication processes and their evolution.

Ethical Considerations

Avatars also present some methodological advantages for scholars. Virtual worlds represent constantly evolving communicative contexts (Castronova, 2006; Williams, 2010). Virtual environments can also enable social scientists to examine questions that are impractical, unethical, or even impossible to study in natural environments (Blascovich et al., 2002; Nowak, 2015; Schönbrodt & Asendorph, 2011), though some uses of avatars may yield antisocial outcomes. Given that the effect of embodying different avatars one time in a lab can influence off-line behaviors and attitudes days or weeks later (Ahn et al., 2016; Klimmt, Hefner, Vorderer, Roth, & Blake, 2010), researchers and designers must carefully consider how these experiences may influence others long term.

Although there may be prosocial effects of embodying avatars depicting races, or identities different from our corporeal bodies, researchers, designers, and users must be careful to avoid antisocial effects such as the reinforcement of stereotypes and the entrenchment of bias. Designers must also ensure that people have diverse and appropriate options for self-presentation so as not to marginalize underrepresented groups (Brock, 2011; J. E. R. Lee, 2014), and be cautious about when they allow avatars to display stereotypically consistent behaviors (Fox & Bailenson, 2009b; Ratan & Sah, 2015).

Additionally, although we have discussed the malleability of one's own avatar, we should also consider the potential for users to control others' avatars in digital environments and how that might affect interactions. There may be benefits to allowing people to select the avatar that represents their interaction partner or presents them with information. For example, participants who were allowed to design a salesperson's avatar rated the source and the brand more highly than participants who were not allowed to design the person's avatar (Hanus & Fox, 2015). At the same time, there may be antisocial effects of this affordance, as malicious users could take the opportunity to create negative representations such as offensive stereotypes or use this information to manipulate people (e.g., to create political propaganda). Regardless, this level of control over the message source is unprecedented in face-to-face environments and presents interesting challenges to our understanding of the communication process.

In summary, existing research on avatars has not only allowed us to understand more about how people use, perceive, and are affected by avatars, but it has also illuminated communication processes more broadly. Going forward, there is no shortage of ways in which avatar research can lend further insight into human communication, but researchers must carefully consider the ethical implications of research designs and the potential for long-term effects of avatar interactions.

Conclusion

The use of avatars in computer-mediated communication and as stimuli to extend our understanding of processes in communication research is both theoretically and practically important. People are spending considerable time engaged in interactions mediated by phones and computers, which is affecting how they present themselves, how they perceive others, what they learn, and how they relate to the world around them. The research on avatars is in its relative infancy, but has demonstrated rather consistently that people follow similar processes in communicating via computer media that they follow face-to-face (Nass & Moon, 2000), and that the type of avatar used in an interaction influences perceptions, attributions, and behaviors (Nowak & Rauh, 2008; Yee & Bailenson, 2007, 2009).

One contribution of this review is identifying the varied definitions of the term *avatar* employed by Communication scholars, which underscores the importance of researchers clearly explicating and defining the way they are using the term. Many terms never have a single accepted definition; thus, a consensus on the meaning of the term may not be needed as long as researchers provide clear conceptual and operational definitions. The varied use of the term, however, can make it difficult to generalize or fully understand the effects of avatars on communication processes. Finally, without consistent meaning of a construct, it is difficult to synthesize existing research, replicate findings, or advance theory (Chaffee, 1991).

In synthesizing the work on avatars in person perception, this review clarified some existing theoretical approaches relevant to evaluating and making attributions regarding avatars. This review has also shown that there are specific constraints in avatar-mediated environments that determine the range of possible selves one can convey. These limitations can have unintended effects on both the person creating the avatar as well as other users, who will naturally make inferences about the person based on their avatar. Researchers and users in these environments should consider these constraints and their implications as they interact and conduct research. Erroneous inferences and attributions may be made about the person based on the avatar that represents them, or people may feel a person intentionally deceived them even though the system's constraints may have forced them to make those choices. For example, a woman may not want to represent herself as hypersexualized and scantily clad, but in many video games, these are her only options for female avatars. Other players may judge her negatively or target her for harassment because she "chose" to represent herself as a hypersexualized female without acknowledging that it was her only choice if she wanted a female avatar. A woman in this situation could choose a male avatar to avoid being

hypersexualized, though she may be accused of deception.

Distinctions in processing may become more influential as advances in graphics capabilities, speech agents, and artificial intelligence make virtual entities more and more realistic and human-like. Over time, as humans gain experience interacting with avatars, robots, or other computer agents, they may make rational decisions to determine what social categories are useful for evaluation. We may see the development of new categories that will become relevant in perceiving others represented by avatars. Further research on this question can enlighten our understanding of person perception more broadly (Blascovich & Bailenson, 2011; Blascovich et al., 2002; Nowak, 2015; Schroeder, 2002).

The goal of this review was to synthesize research examining the role avatars on communication processes, highlighting major advancements and limitations while also making recommendations for future communication researchers. Although this work relatively nascent, the prevalence of CMC in everyday social interaction underscores its importance and the necessity for further introspection. As is generally true, the more one understands about elements of a communication process, the more complicated it seems. Thus, there is an ongoing need for more nuanced and focused research to explicate these processes. We look forward to watching this area of research continue to mature and expand as researchers outside of the domain of digital environments begin to appreciate how avatar research can inform their inquiry as well.

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