


What Does My Avatar Say About Me? Inferring Personality From Avatars

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Abstract

Many individuals now meet and develop friendships while online. As a result, people must form impressions of online acquaintances based on that person's online representation. Here, we investigate personality inferences and intentions to befriend based solely on simple avatars (i.e., customized cartoon representations of the self). Our data show that some traits are more easily inferred from avatars than others, avatars can communicate accurate and distinctive information regarding personality, and individuals with certain personality traits create avatars that are more likely to be perceived accurately. We also found that agreeable and normative individuals created avatars that elicited more desire for friendship from others, implying that the impression given by one's digital avatars may have social consequences.

Keywords

person perception, avatars, accuracy

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Introduction

Technological advances have produced virtual spaces where individuals gather and interact (e.g., online video games, chat rooms; Steinkuehler & Williams, 2006). In some virtual environments, individuals rely upon a visual graphic to represent themselves, known as an avatar. An avatar is typically an image that represents the self in the virtual world, ranging from very simple drawings (e.g., Mii characters for the Nintendo Wii) to quite detailed three-dimensional renderings of characters (e.g., *World of Warcraft*). A growing body of exciting research has begun to investigate these avatars and the outcomes of their use (e.g., Yoon & Vargas, 2014). In particular, avatars have received a considerable amount of attention from researchers who are interested in identity because avatars allow individuals to express (or suppress) various physical and psychological traits (Hoffner, 2008; Vasalou & Joinson, 2009; Williams, Kennedy, & Moore, 2011). This ability to selectively represent the self highlights the importance of first impressions based on avatars. Although there is evidence that avatars can convey accurate personality information about their creators (Belisle & Bodur, 2010), little is known about how individual differences might moderate the accuracy with which an individual is perceived or the social consequences of judgments based on avatars. Here, we investigate a number of questions related to both the accuracy of personality perception within the world of avatars and the social consequences of these impressions.

First Impressions and Computer-Mediated Communication (CMC)

Interacting via CMC can affect how we form impressions of others. Because impression formation is an important aspect of any social interaction, while online individuals identify CMC-specific cues to form impressions and employ these cues to make impressions on others. These cues can be minimal and text based, such as emoticons, usernames, and even writing style (Heisler & Crabill, 2006; McAndrew & De Jonge, 2011; Walther, Loh, & Granka, 2005), but even these minimal cues can be used to form impressions of useful social categories such as gender and disposition (Cornetto & Nowak, 2006; McAndrew & De Jonge, 2011). Overall, these CMC-specific cues seem to convey accurate information about individuals' personality. Accurate impressions can be formed based on text-based interactions (Rouse & Haas, 2003), even when only very simple cues such as an email address are available (Back, Schmukle, & Egloff, 2008). However, there is some evidence that this accuracy is lower than that found in face-to-face interactions (Okdie, Guadagno, Bernieri, Geers, & Mclarney-Vesotski, 2011).

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Some online environments, such as social networking profiles (Back, Stopfer, et al., 2010; Stopfer, Egloff, Nestler, & Back, 2013) and personal websites (Vazire & Gosling, 2004), contain both verbal and nonverbal cues, and these have also been associated with accurate personality judgments.

Beyond the question of accuracy, researchers have explored how liking emerges based on first impressions (e.g., Back, Schmukle, & Egloff, 2010, 2011; K ufner, Nestler, & Back, 2013). Certain individual differences tend to be associated with positive social outcomes in the real world. For example, physically attractive individuals tend to be evaluated and treated more positively (Dion, Berscheid, & Walster, 1972), and narcissists self-present in ways that tend to elicit liking from others on first impression (Back, Schmukle, & Egloff, 2010). Most germane to the current context, social network profiles that communicate communal traits and creativity elicit judgments of liking (Stopfer et al., 2013). Overall, it seems that certain individuals tend to present themselves in ways that increase the likelihood of positive social outcomes at first impression. In the current study, we focus on impressions based on avatars, in light of their prevalence in online environments and the exciting surge of research underscoring their importance with respect to identity.

Impressions based on avatars. Avatars are ubiquitous in online environments and range widely in their implementation, from static images to dynamic three-dimensional characters (Belisle & Bodur, 2010; Holzwarth, Janiszewski, & Neumann, 2006). They can also be an important tool to foster relationships, increasing feelings of social connectivity and emotional involvement (e.g., Taylor, 2011). When encountering an avatar, individuals appear to use visual cues encoded in the avatar to form an impression of that avatar and its user. As individuals often anthropomorphize avatars (Nass & Moon, 2000), it is no surprise that perceivers respond to avatars in a manner similar to how they form impressions of individuals in the real world (e.g., based on physical appearance; Naumann, Vazire, Rentfrow, & Gosling, 2009). Tattooed avatars, for example, are perceived as being sensation-seeking and risk-taking (Wohlrab, Fink, Kappeler, & Brewer, 2009). How androgynous and human-like the avatar appears also influences the perceived credibility and attractiveness of avatars (Nowak & Rauh, 2006), and these evaluations extend to the credibility of the avatar's user (Nowak & Rauh, 2008). In addition, these same cues influence whether users would like to be represented by a given avatar (Nowak, Hamilton, & Hammond, 2009; Nowak & Rauh, 2006). The visual characteristics of avatars, therefore, play an important role in both how others are perceived and also how individuals choose to represent themselves. But do these cues accurately reflect and communicate an individual's real-world traits?

There are reasons to expect that an avatar's cues may not lead to accurate impressions of its user. For one, virtual environments are well suited for identity exploration, so users

might adopt identities different from their actual real-world identity (Hoffner, 2008; Kafai, Fields, & Cook, 2010). Because avatars can easily be customized, your avatar does not need to match your own appearance and can embody any characteristics you wish (Dunn & Guadagno, 2012; Vasalou & Joinson, 2009). In addition, an avatar may provide an opportunity to deviate from one's social identity (Williams et al., 2011), motivated by enjoyment, entertainment, or desires to manage self-presentation (Dunn & Guadagno, 2012; Williams et al., 2011). The latter can be achieved by emphasizing desired psychological traits or physical characteristics, such as confidence, attractiveness, or intelligence (Dunn & Guadagno, 2012; Vasalou & Joinson, 2009; Vasalou, Joinson, Banziger, Goldie, & Pitt, 2008). Because the positive evaluations of an avatar are often extended to the user (Nowak & Rauh, 2008), individuals may be highly motivated to customize avatars in ways inconsistent with reality, resulting in inaccurate impressions formed by others.

However, there are reasons to believe that avatars may contain valid identity cues. Individuals who are uncomfortable or marginalized in the real world may view virtual worlds, and the avatars within them, as an opportunity to express their "true selves" (Williams et al., 2011). Research has borne out this idea, with individuals often customizing or choosing avatars to reflect their true personalities, mental states, and interests (Kafai et al., 2010; Park & Henley, 2007). Individual differences such as self-esteem, gender, and personality guide avatar customization (Dunn & Guadagno, 2012). Similar to how our clothes in the real-world convey information about ourselves to others (e.g., Gillath, Bahns, Ge, & Crandall, 2012), the clothes we choose for our avatars may serve a similar function and may even correspond to our actual clothes (Borkenau & Liebler, 1992). Consistent with the idea that avatars can accurately reflect identity, individuals choose and prefer avatars perceived to be similar to themselves (Nowak & Rauh, 2006, 2008). Overall, there is research to support the idea that individuals may be motivated to create and employ avatars that are representative of their true identity. Our study employs the Brunswik Lens Model to examine questions regarding the accuracy of personality perceptions based on avatars (Brunswik, 1956).

The Brunswik Lens Model. The Brunswik Lens Model postulates that observable cues found in the environment (e.g., cues present in customized avatars) provide a lens through which perceivers observe constructs that may not be directly observable (e.g., an avatar creator's true personality; Brunswik, 1956). Accuracy in personality perception is driven by two components: (a) cue validity, the relationship between phenomena (e.g., personality) and observable cues; and (b) cue utilization, the relationship between cues and how they are employed by perceivers. Accuracy occurs when there is a high degree of convergence between cue validity and cue utilization. The Brunswik Lens Model can be used to identify both good and bad sources of personality information, across many types of stimuli.

The Current Study

The primary research questions for the current study center on the accuracy of personality impressions and the elicitation of friendship intentions in others. As a starting point, we wished to replicate the trait-level accuracy findings of Belisle and Bodur (2010) using a novel set of avatars to examine the generalizability of their findings. Building on trait-level accuracy, our study will examine the robustness of this accuracy by taking into account a factor not considered in past work: the role of sex stereotypes. In an avatar context, sex cues can activate social categorization (i.e., gender), which may subsequently lead to the application of gender stereotypes (Cornetto & Nowak, 2006). Women are often perceived as more agreeable and less emotionally stable than men (e.g., Gosling, Ko, Mannarelli, & Morris, 2002; Spence, 1993), and so perceptions of avatars might be influenced by judgments that an avatar is female. These stereotypical judgments of others based on sex might also contribute to accuracy if the stereotypes about men and women correspond to actual sex differences. It is especially relevant to examine these stereotypes in avatars because the visual cues provided by avatars may provide more opportunities to elicit sex categorization in perceivers compared with more cue-lean CMC environments (e.g., usernames; Cornetto & Nowak, 2006). Based on past research on real-world perception, we hypothesized that sex stereotypes would influence perceiver judgments such that ratings of agreeableness and emotional stability would be predicted by the sex of the avatar, above and beyond the actual self-reported levels of these traits by creators.

After exploring the robustness of trait-level accuracy, we move to the novel question of whether individuals' overall personalities are also accurately perceived, known as profile-level accuracy. In other words, can an avatar provide accurate information about an individual across their personality profile? To explore this question properly, we additionally took into account the fact that accuracy in personality perception can be driven by normative expectancies (Biesanz, 2010; Furr, 2008). That is, reports of personality are influenced to some degree by the tendency for these reports to reflect the average profile of the population (e.g., an expectation of what the typical person is like). It is important to account for normative influences when investigating profile similarity (e.g., the similarity between self-reported and perceiver-rated personality profiles) as such influences can inflate similarity estimates. Prior research has not determined whether accuracy in person perception based on avatars is due to reliance on normative expectancies. Thus, we included two components of profile similarity in our analysis: (a) overall accuracy, or the level of agreement between the creator and the rater regarding the creator's personality; and (b) distinctive accuracy, or how well raters can predict the personality of creators above and beyond impressions of what the typical person is like (e.g., how much more or less extraverted a creator is beyond an average person's level of extraversion;

Furr, 2008). We hypothesized that overall profile-level accuracy would be possible in the form of a positive correlation between the average rated personality profile and self-reported personality profiles by creators. Furthermore, we hypothesized that once the influence of normative expectancies was taken into account, this correlation (i.e., distinctive accuracy) would be smaller in magnitude but remain positive and nonzero. This would indicate some influence of normative expectancies.

The previous set of questions and hypotheses addressed whether traits and trait profiles can be accurately inferred from avatars. Also of interest is a related question that has not been previously examined: who creates an avatar that is perceived with profile-level accuracy? Specifically, what personality traits are associated with creating an avatar that is perceived more accurately? This differs from the question of what traits may be inferred accurately. For example, trait openness may be perceived accurately from avatars across a group (based on a trait-level analysis). However, an individual high in openness may also tend to choose atypical avatar cues to represent their other personality traits, therefore reducing the overall accuracy with which their entire personality profile can be inferred. The fact that some personality traits predict higher levels of discrepancy between real-life appearance and the appearance of one's avatar suggests that personality may be an important moderator of accuracy (e.g., Dunn & Guadagno, 2012). Although too little is known about who promotes accurate perceptions in online contexts for us to form concrete hypotheses, we expected that individuals who are high on expressive traits will be most likely to be perceived with greater accuracy (i.e., extraversion and agreeableness; Ambady, Hallahan, & Rosenthal, 1995).

Finally, first impressions made online should not be considered in isolation, as they take place within a social context often motivated by the development of new friendships. Previous research using social network profiles or photographs has found that even very brief exposure to a target is sufficient to influence individuals' liking of the target (e.g., Back, Stopfer, et al., 2010; Stopfer et al., 2013). The current study extends past research by examining the social consequences of impressions based on avatars: What kinds of people create an avatar that elicits a desire to befriend its creator? As extraverted individuals tend to be more popular (Back et al., 2011; Eaton & Funder, 2003), we hypothesize that greater extraversion in creators will be positively correlated with a greater desire for friendship in perceivers. In addition, we investigated what specific cues, associated with different creator personality traits, would predict greater friendship intentions on the part of perceivers. Finally, having a personality profile that closely matches a normative profile can be indicative of psychological adjustment or social desirability (Furr, 2008), and this may influence intentions to befriend. We hypothesized that global normativeness, the similarity between a creator and the average personality profile (e.g., what people in general are like), would be positively correlated with intentions to befriend an



Figure 1. Example avatars.

avatar creator. An additional factor to consider is how revealing an avatar is with respect to its creator's personality. Avatars that communicate more of the creator's true personality might be more liked because people would seem to prefer others who present themselves in an open and honest manner. Therefore, we hypothesized that avatar creators who were perceived with higher levels of accuracy would also elicit greater intentions to befriend.

Method

This study involved two phases: In Phase 1, participants created customized avatars, and in Phase 2, a different set of participants viewed and rated the avatars created in Phase 1.

Participants

Participants in both Phase 1 and Phase 2 were recruited from the undergraduate research participant pool at a large Canadian university and received partial course credit for participation. There were 99 participants (50 male) in Phase 1, who ranged in age from 17 to 40 years, $M = 19.76$ years, $SD = 3.76$ years. In Phase 2, 209 individuals (60 male), ranging in age from 16 to 36 years ($M = 19.42$ years, $SD = 2.68$ years), participated.

Materials

Avatar creation task. Participants created an avatar using an online tool: weeworld.com. This website allows people to choose a basic form for their avatar (e.g., sex, skin tone) and customize it along various dimensions, including hair, clothing, and accessories (Figure 1). All participants consented to having these avatars presented to other research participants.

Big Five Inventory–44 (BFI-44). To assess personality, participants completed the BFI-44 (John, Donahue, & Kentle,

1991). The BFI-44 is based on the five-factor model of personality and assesses the five major traits: (a) openness, (b) conscientiousness, (c) extraversion, (d) agreeableness, and (e) neuroticism. This measure consists of 44 descriptive phrases, which respondents rate with respect to self-characterization. Responses are given using a 5-point Likert-type scale that ranges from 1 (*disagree strongly*) to 5 (*agree strongly*). Example items include “I see myself as someone who is full of energy” (extraversion) and “I see myself as someone who gets nervous easily” (neuroticism). The BFI-44 is a reliable and valid method of measuring five-factor personality (John & Srivastava, 1999). We used scores from the BFI-44 as a comprehensive measure of personality in all analyses that examined how creators' personalities might relate to being accurately perceived and the elicitation of a desire to befriend.

Big Five Inventory–10 (BFI-10). Personality was also measured using the BFI-10 (Rammstedt & John, 2007), an abbreviated version of the BFI in which each of the five-factor traits is measured by two items, resulting in a total of 10 items. Each trait is measured by one true-scored item and one reverse-scored item. For example, extraversion is measured by the two items, “I see myself as someone who is outgoing, sociable” and “I see myself as someone who is reserved.” Respondents rate each statement on a 5-point Likert-type scale that ranges from 1 (*disagree strongly*) to 5 (*agree strongly*). Despite its brevity, the BFI-10 has demonstrated good test-retest reliability, as well as good convergence with more detailed assessments of personality such as the 44-item BFI (Rammstedt & John, 2007). The BFI-10 was only used to determine profile accuracy, to allow for a direct comparison between self-reported personality profiles and perceived personality profiles.

Desired friendship. Whether an individual was interested in becoming friends with the creator of an avatar was measured using a single item, “I would like to be friends with the person who created this avatar.” Responses to this item were provided using a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Procedure

Phase 1 was conducted in a computer lab where participants created an avatar and subsequently completed the BFI-44. All participants were given the following instructions: “Please create an avatar representation of yourself.” Half the participants were provided with an additional instruction, “Your avatar should represent who you really are (e.g., your personality); remember, your avatar does not need to look like you!” Initial analyses indicated no differences between these two groups, so these groups were collapsed for the final analysis. There were no cross-sex or gender atypical avatar representations in this sample. Avatar creators also completed the BFI-10

Table 1. Trait-Level Accuracy, Cue-Based Trait-Level Vector Correlations, and Regressions of Accuracy Controlling for Gender.

Trait	Trait-level accuracy (β)	Vector-column correlations	Gender (β)	Accuracy (β), controlling for gender
Extraversion	.24*	.43*	-.04	.24*
Agreeableness	.13*	.41*	-.09	.11*
Conscientiousness	.03	.15	-.29*	.01
Neuroticism	.10*	.40*	-.09	.08
Openness	.04	.18	-.12*	.04

* $p < .05$.

because this was the measure that perceivers would later employ to infer personality from the avatar. Having the creators' BFI-10 scores allowed us to make a direct comparison between self-rated personality and inferred personality, based on the same measure, when exploring profile-level accuracy. Finally, demographic information was collected.

Data for Phase 2 were collected online using the Qualtrics survey client (www.qualtrics.com). A second set of participants, with no overlap from Phase 1, were shown a subset of 15 to 16 avatars created in Phase 1. We created seven subsets by randomly distributing the avatars from Phase 1. Participants in Phase 2 were randomly assigned to rate a subset when they were recruited. These participants were given the following instructions:

You will see a series of digital avatars and be asked to rate each one based on the personality of its creator. The questionnaire provided lists a number of characteristics that may or may not describe the individual you've been asked to rate . . . Examine each avatar and try to predict the personality of the person who created that avatar.

Each avatar was rated by a minimum of 20 different people. For each avatar, participants also indicated whether they would like to befriend the creator of the avatar.

To evaluate the consensus among raters, overall mean single-perceiver interrater consensus (i.e., agreement on BFI personality ratings among all 209 raters and across all avatars) was calculated using an intraclass correlation, $ICC(2, 1) = .19$. Overall mean average-perceiver interrater consensus (i.e., agreement of personality ratings across raters within each subset) was also calculated, $ICC(2, k) = .87$, where k was between 24 and 33 (the number of participants who rated each subset).

A set of 111 potential cues was identified based on the avatar customization options, and the number of avatars possessing any given cue was noted (Table 3; Online Appendix A). All 99 avatars were then coded for these cues by two research assistants who acted as independent raters. These same raters also rated the avatars on three additional dimensions based on overall appearance: stylishness, casualness, and formality. For all continuous cues (e.g., rated stylishness), coder ratings were averaged. Mean interjudge agreement was calculated by correlating the two raters' scores on

each continuous item and then averaging correlations across items. Interjudge agreement across items averaged .63. For binomial cues (e.g., brown hair), any disagreement between raters was resolved by the first author. Cue utilization was calculated by correlating the coded physical cues of the created avatars with the average perceived score for each trait. Calculating cue validity followed a similar format but employed the avatar cues and self-reported personality traits from the BFI-44. Avatar cues, their cue utilization, and cue validity values can be found in Table 3 and Online Appendix A.

Results

Can Individual Personality Traits Be Accurately Inferred From Avatar Cues?

Trait-level accuracy was calculated by correlating the average rating of each trait with centered self-reported creator scores on the BFI-44. Because subsets of avatars were rated by subsets of perceivers (i.e., a planned missing design), a multilevel approach was utilized. The fixed effect from the model was standardized and represents the average relationship between the creator self-report and perceiver ratings of that trait, on average across perceivers (Table 1, column 1). According to this analysis, avatars can provide accurate information regarding trait extraversion, agreeableness, and neuroticism but not conscientiousness or openness.

To provide some insight into the process of how trait-level accuracy might be achieved, we examined the relation between cue utilization and cue validity. Using vector-column correlations (Funder & Sneed, 1993), we were able to examine whether cue choices associated with creator personality were also utilized by perceivers. Cue utilization and cue validity correlations were first transformed using Fisher's r -to- z formula to form vectors. Cue utilization and cue validity vectors were then correlated across all 114 cues for each of the Big Five traits. This procedure characterizes the extent to which cue utilization and cue validity are congruent (Table 1, column 2). Vector correlations for extraversion, agreeableness, and neuroticism were all significant and positive, whereas the vector correlations for conscientiousness and openness did not reach threshold for significance (although openness fell just above threshold, $p = .06$). This indicates that the way individuals customize avatars to reflect their

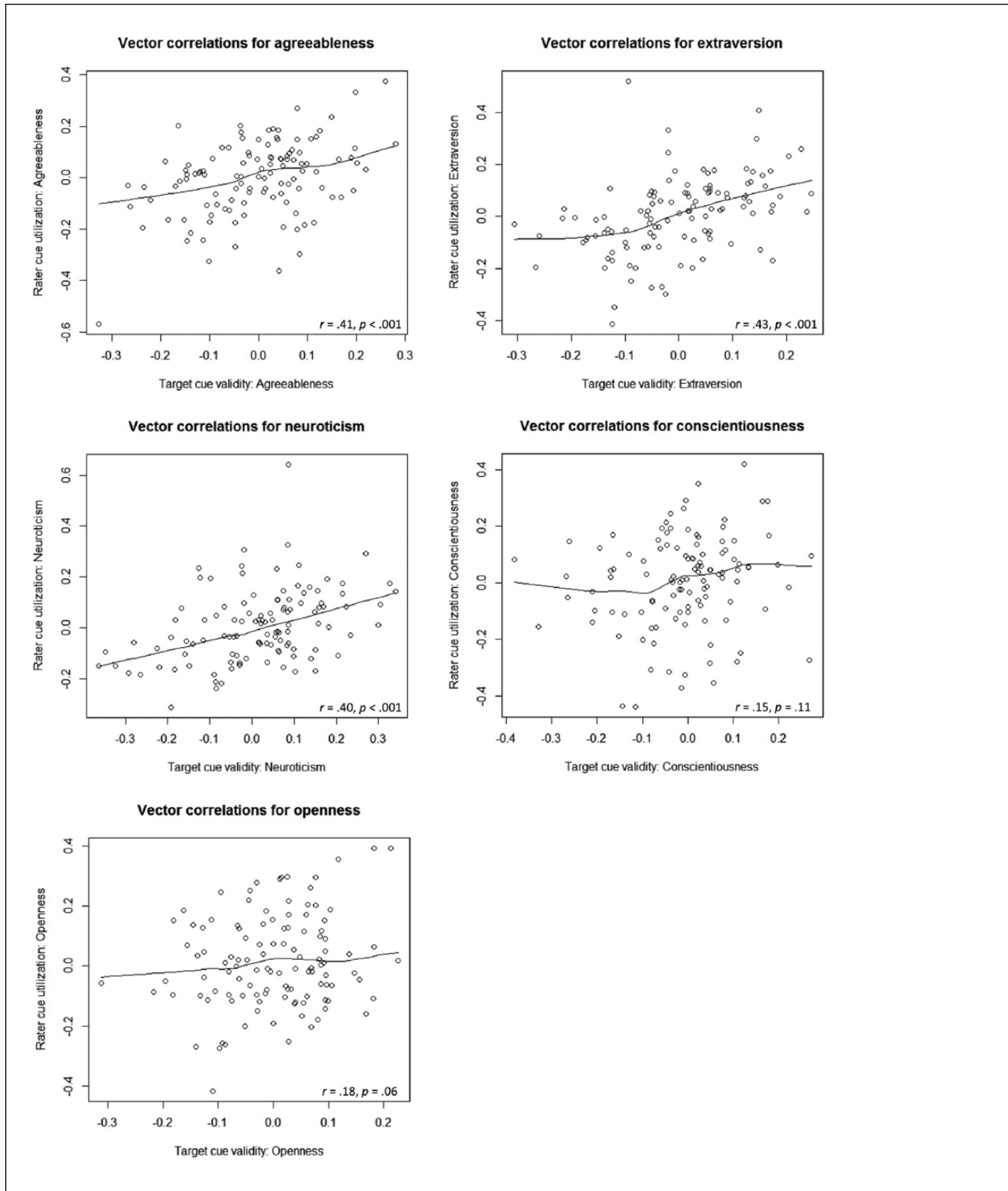


Figure 2. Scatterplots for cue utilization and cue validation by trait with fitted loess curve.

own traits is congruent with how perceivers use these avatar cues to infer personality (for all traits except for conscientiousness and perhaps openness). To further illustrate these

vector correlations, we plotted scatterplots of cue utilization against cue validity for each trait and fitted each plot with a loess curve (Figure 2).

Table 2. Bootstrapped multiple mediation analyses examining whether valid and utilized cues mediate the association between self-reported and perceived personality for each trait.

Trait	Relevant cues	Indirect effect, β	Indirect effect, 95% CI	p
Extraversion	Total	.05	.00, .11	.05
	Shorts	.03	-.01, .07	.15
	Jewelry	.02	-.01, .06	.20
Agreeableness	Total	.08	.03, .13	< .01
	Open eyes	.01	-.02, .04	.50
	Neutral expression	.07	.02, .12	.01
Conscientiousness	-	-	-	-
Neuroticism	Grey or beige shoes	.03	-.00, .06	.07
Openness	Number of accessories	.03	-.00, .06	.06

To investigate whether the valid and utilized cues could help explain the accurate perception of each trait, we conducted a series of bootstrapped multiple mediation analyses. For each of the Big Five traits, we conducted a regression with creator personality predicting rated personality traits and entered avatar cues that were both utilized and valid as potential mediators (Table 2). Mediation was observed in terms of a nonzero total indirect effect of the cues for extraversion (shorts and jewelry) and agreeableness (open eyes and a neutral expression). The total indirect effect of the cues for neuroticism (gray or beige shoes) and openness (number of accessories) approached significance, with the lower bound of the bootstrapped 95% confidence interval (CI) just including 0. No cues for conscientiousness were both valid and utilized.

Do Sex Stereotypes Affect the Accuracy of Personality Perception From Avatars?

To investigate the influence of sex stereotypes on perception, we conducted separate regressions for each mean-rated personality trait with avatar sex (dummy coded as females = 0 and males = 1) and self-reported creator personality included as predictors. Including self-reported creator personality allowed us to examine whether avatar sex predicts the rated personality trait above and beyond the actual self-reported personality of the creator (Table 1, columns 3 and 4). In the case of only two regressions, for conscientiousness and openness, was avatar sex a significant predictor after taking into account self-reported creator personality. This demonstrates that ratings of conscientiousness and openness were driven to some extent by the perceived sex of the avatar. Specifically, male avatars were seen as less conscientious and less open to experience. Impression formation based on avatars does appear somewhat driven by gender-based stereotypes, although the observed traits for which this was the case did not correspond to our hypotheses. Importantly, in light of the fact

that female creators did not report more conscientiousness or openness relative to males, it is unlikely that the stereotypes applied by perceivers improved accuracy in personality perception, conscientiousness: $t(97) = -1.14, p = .26, d = -0.23$; openness: $t(97) = 0.28, p = .78, d = 0.06$.

Can Personality Profiles Be Accurately Inferred From Avatar Cues, in Light of Normative Expectancies?

Moving beyond the accuracy associated with individual traits, we subsequently examined whether entire personality profiles could be accurately inferred from avatars. For this analysis, accuracy is considered a profile-level correlation (Funder, 1999), where each target's BFI-10 responses were correlated with the mean BFI-10 profile provided by the perceivers to directly compare perceived and self-reported personality. The raw associations were considered a measure of overall accuracy and were subjected to a single sample t test with the null-hypothesis being no correlation between self-reported creator personality and rated personality (test value of 0). Overall accuracy was statistically different from 0, $r = .26, t(98) = 7.75, p < .001, 95\% \text{ CI } [.19, .32]$. To parse out the effect of normative influence on personality judgment, we calculated distinctive and normative accuracy using a multilevel model following the procedures outlined by the Social Accuracy Model (Biesanz, 2010). Similar to the trait correlations, the multilevel model allowed us to account for the fact that subsets of avatars were being rated by subsets of perceivers. The fixed effects from this model were considered. On average, across avatar creators and perceivers, there was statistically significant agreement between self-reported and rated personality profiles after accounting for normative influences (i.e., distinctive accuracy), $b = .04, p = .03$. In addition, the results for normative accuracy also reached statistical significance, $b = .31, p < .001$, indicating that personality inference from avatars has a normative component. These results were consistent with our hypotheses.

Table 3. Cue Validity and Cue Utilization for Cues Pertaining to Friendship Intentions.

Target BFI_E	Target BFI_A	Target BFI_C	Target BFI_N	Target BFI_O	Avatar cue	Rated BFI_E	Rated BFI_A	Rated BFI_C	Rated BFI_N	Rated BFI_O	Friendship	Base rate
-.02	.25*	.12	.04	.03	Open eyes	.32*	.36*	.40*	-.03	.29*	.50*	94
-.02	.20	-.01	.15	.06	Smile	.14	.32*	.26*	-.17	.20*	.32*	50
.00	.08	-.00	.06	.02	Oval face	.01	.15	.28*	-.02	.12	.31*	56
.24*	-.04	.08	.08	.06	Brown hair	.09	.20*	.22*	-.07	.12	.25*	37
.15	.07	.27*	-.19	.03	Grin	.39*	.11	.10	-.30*	.13	.22*	31
-.19	.15	.02	.05	-.05	Sweater	-.01	.23*	.34*	.03	.09	.20*	18
.031	-.15	.06	-.26*	.17	Short hair	.06	-.16	-.34*	-.18	-.16	-.22*	32
.17	.04	.05	.04	.10	Sunglasses	.17	-.35*	-.28*	-.13	.19	-.23*	29
.13	.03	.04	-.05	.08	Hat	.13	-.08	-.13	-.16	.29*	-.26*	27
-.12	-.10	-.08	-.13	-.09	Black hair	-.17	-.31*	-.21*	.23*	-.25*	-.30*	44
-.12	-.10	-.32*	.09	-.03	Other mouth expression	-.39*	-.17	-.15	.57*	-.12	-.32*	5
-.09	-.32*	-.14	-.02	-.11	Neutral expression	.48*	-.52*	-.41*	.30*	-.40*	-.57*	13

Note. BFI_E = Extraversion; BFI_A = Agreeableness; BFI_C = Conscientiousness; BFI_N = Neuroticism; BFI_O = Openness to experience.

* $p < .05$.

What Creator Traits Predict the Creation of an Avatar That Is Accurately Perceived?

To identify which personality traits of a creator were associated with creating an avatar perceived accurately, the previous multilevel model was expanded to include each self-reported creator personality trait in turn (as measured by the BFI-44). Individuals who were more extraverted ($b = .07, p < .001$), more agreeable ($b = .08, p < .001$), and more conscientious ($b = .04, p < .001$) were more likely to be perceived with distinctive accuracy, whereas individuals who were more neurotic were less likely to be perceived with distinctive accuracy ($b = -.06, p < .001$). Creator openness was not related to being perceived with distinctive accuracy ($b = .01, p = .69$). To examine which of these traits uniquely predicted accuracy, all five traits entered simultaneously as potential moderators, along with gender and age as covariates (Table 2). Creator extraversion, agreeableness, and neuroticism remained unique predictors, with extraversion and agreeableness predicting greater distinctive accuracy and neuroticism predicting less accuracy.

How Is Creator Personality Related to Intentions to Befriend That Creator Based on an Avatar?

We began by asking whether certain types of individuals are more likely to create an avatar that others wish to befriend. To do so, we analyzed multilevel models with the creator's self-reported personality (i.e., trait scores from the BFI-44) predicting perceivers' average rated likelihood of befriending that individual, reporting the standardized fixed effects. More agreeable creators made avatars more likely to evoke friendship intentions in perceivers ($b = .09, p = .02$). No other personality trait for creators predicted an increased likelihood of eliciting friendship in perceivers, extraversion:

$b = .04, p = .27$; conscientiousness: $b = .02, p = .63$; neuroticism: $b = -.02, p = .66$; and openness: $b = .02, p = .63$. Because we hypothesized that more extraverted creators would be more likely to elicit friendship intentions, this finding was inconsistent with our hypothesis.

To explore the question of friendship intentions further, we engaged in an exploratory vector correlation analysis to examine whether cues associated with certain traits were linked to a desire to befriend. This is akin to the previous analysis examining the convergence between cue validity and utilization, but in this case, friendship intentions take the place of cue utilization. We calculated correlations between avatar cues and scores on the befriending item and applied a Fisher's r -to- z transformation. We then calculated a vector correlation between cue validity and friendship intentions across the Big Five traits. This allowed us to examine how avatar customizations were associated with perceivers' intentions to befriend, with regard to the creator's personality. The vector correlation between creator agreeableness and friendship intentions was strongest ($r = .57, p < .001$), but creator conscientiousness was also statistically significant, $r = .31, p < .001$. In other words, agreeable and conscientious individuals tended to customize their avatars with cues that were also associated with the elicitation of friendship intentions. The vector correlations between friendship intentions and creator extraversion ($r = .20, p = .09$), neuroticism ($r = .10, p = .31$), and openness ($r = -.04, p = .65$) did not reach threshold for statistical significance. Cues that were either valid or utilized in determining friendship intentions are summarized in Table 3. Avatars with open eyes, a smile or grin, an oval face, brown hair, and/or a sweater were more likely to elicit friendship intentions. In contrast, avatars with a neutral expression or any other expression (other than a smile), black hair, short hair, a hat, and/or sunglasses were less likely to elicit friendship intentions (Figure 1). Most of

these cues were correlated with perceptions of conscientiousness and to a lesser degree agreeableness (positively or negatively, consistent with the elicitation of intentions; Table 3).

In light of the fact that creator agreeableness was the only unique predictor of intentions to befriend, we further examined whether specific cues could account for this relationship. There were two cues related to both creator agreeableness and friendship intentions: open eyes and a neutral expression (negative predictor). A bootstrapped multiple mediation analysis indicated a nonsignificant indirect effect of open eyes ($\beta = .03$, 95% CI $[-.00, .07]$) and a significant indirect effect of neutral expression ($\beta = .07$, 95% CI $[.02, .12]$), with a significant total indirect effect, $\beta = .10$, 95% CI $[.04, .16]$. This means that the relationship between creator agreeableness and intentions to befriend could be partially explained by customizing an avatar to have open eyes and avoiding a neutral expression.

Along with customization cues, other factors associated with impressions of avatars might help to explain friendship intentions. Two such factors are how accurately the avatar is perceived and also how normative the avatar is perceived to be. We included friendship intentions in the previous multi-level model examining distinctive and normative accuracy to investigate the linear relationship between these components of accuracy and desired friendship. Distinctive accuracy was not related to desired friendship ($b = -.01$, $p = .39$), but global normativeness ($b = .29$, $p < .001$) predicted friendship intentions. In support of our hypothesis, those who made avatars perceived as typical—those whose self-reported personality was close to the average personality—were perceived more positively by perceivers.

Discussion

In this study, we addressed a number of questions related to impressions formed of others based on digital avatars. Our results confirmed that avatars can provide accurate personality information at the level of individual traits, with extraversion, agreeableness, and neuroticism accurately predicted from avatars. Accuracy in assessing extraversion has also been observed based on static real-world cues (e.g., pictures; Borkenau & Liebler, 1992; Funder & Dobroth, 1987; Stopfer et al., 2013). This suggests that extraversion is highly observable in both online and real-world contexts, perhaps contributing to its high level of accurate assessment across environments (John & Robins, 1993). The fact that we observed accuracy for agreeableness and neuroticism in the avatar context diverged from past work using real-world thin-slice exposure, as cues for these traits are generally less observable in those contexts (Borkenau & Liebler, 1992; Funder & Dobroth, 1987). This agreeableness finding appears to be reliable, however, as it replicates a past study on avatars (Belisle & Bodur, 2010). Neuroticism, in contrast, is not often inferred accurately in CMC contexts (Back, Stopfer, et al., 2010; Belisle & Bodur, 2010; Gill, Oberlander,

& Austin, 2006; Wall, Taylor, Dixon, Conchie, & Ellis, 2013). We also found that conscientiousness and openness were not accurately predicted from the avatars, consistent with past work (Belisle & Bodur, 2010), although conscientiousness is often accurately perceived in the real world (Borkenau & Liebler, 1992; Funder & Dobroth, 1987; Gosling et al., 2002). In interpreting these findings, it is important to emphasize that the avatar context is a relatively cue-lean context compared with the real world. This difference might differentially influence the visibility of certain traits. As past work has shown, some traits become more accurately perceived as cue-richness decreases (i.e., extraversion and neuroticism), whereas other traits become less accurately perceived (i.e., conscientiousness and openness; Wall et al., 2013). Cues to personality in the real world can come either directly in the form of identity claims (choosing to display cues that reinforce one's self-identity) or indirectly in the form of behavioral residue (remnants of behavior driven by personality; Gosling et al., 2002). In the avatar context, it seems that only identity claims are available, with raters being aware that every customization is deliberately chosen. If an avatar is wearing a dirty shirt, the rater knows that this was a deliberate choice and not the accidental outcome of some personality-revealing behavior (i.e., the avatar did not spill ketchup on her clean shirt). There are, therefore, fewer sources of information available in the avatar context relative to the real world, but the meaning of the available information is also different across contexts as the rater knows that the available cues are not present by chance.

When cue validity and cue utilization were considered, there was a congruence observed for extraversion, agreeableness, and neuroticism. The customization cues employed by creators were related to these traits, and raters used these same cues to inform their judgments of these traits. Much less congruence was observed for conscientiousness and openness. One possible explanation for this lower congruence is that the customization choices made available did not provide the necessary options to convey information regarding these traits. It was not possible to choose a dirty or rumpled shirt, for example; all clothing appeared neat and tidy on the avatar. Similarly, the clothing and accessory choices may not have allowed for sufficient creativity to convey high levels of openness. It is also important to stress that we may have observed different results if we had employed more detailed or dynamic avatars that incorporated movement.

Avatar sex characteristics also influenced how raters saw avatar creators. Specifically, when rating avatars created by females, perceivers tended to rate them as being more conscientiousness and open, even after taking into account the creators' true conscientiousness and openness. In other words, the avatar's sex was considered an important cue for predicting conscientiousness and openness. Females, however, did not report being more conscientious and more open, so relying on sex categorization to influence these judgments might have lowered accuracy for these traits overall; conscientious and

openness were the two traits for which trait-level accuracy was not observed. It is somewhat surprising that avatar sex did not influence judgments in typical gender stereotypic directions (i.e., for agreeableness and emotional stability), as we predicted. That said, our results are consistent with past work indicating that sex categorization plays an important role in person perception for CMC contexts (e.g., Cornetto & Nowak, 2006).

Not only can avatars be a source of trait accuracy, but an individual's unique personality profile can also be perceived accurately, even after accounting for normative expectancy. In other words, avatars can provide accurate information about how its creator is different from the average person. Overall accuracy was larger than distinctive accuracy, however, indicating that expectations based on what the average person is like boosted overall accuracy ratings. Furthermore, some individuals are perceived more accurately than others. Identifying who is perceived with more accuracy (i.e., a good target who is high in judgeability) is important because this individual difference is associated with various positive outcomes, including greater psychological adjustment and higher social status (Human & Biesanz, 2013). In our study, more agreeable individuals were more likely to be perceived with greater distinctive accuracy, with high extraversion also exhibiting a similar pattern (but falling just below threshold for statistical significance). These findings are consistent with real-world impression formation, with extraversion and agreeableness predicting expressive or sociable behaviors that are then accurately perceived by others (Ambady et al., 1995; Human & Biesanz, 2013; John & Srivastava, 1999). Individuals who are more social or greatly value harmonious relationships (i.e., those high in extraversion and agreeableness) may invest in accurate representations of their personality as being perceived accurately is related to positive socialization (e.g., Human & Biesanz, 2013). In contrast, we found that individuals higher in neuroticism were perceived with less distinctive accuracy. It is possible that highly neurotic individuals are less well adjusted, which may correspond to a tendency to shield one's personality or needs from others (Human & Biesanz, 2013). This is purely conjectural, however, and this relationship between neuroticism and accuracy should be more directly explored in future research. Another issue to consider is that customizing an avatar is an opportunity to control self-presentation (e.g., Hoffner, 2008), and in this context, personality traits may moderate whether people use this opportunity to pursue accuracy, self-exploration, or impression management. Extraverted and agreeable people may be more motivated by accuracy, whereas highly neurotic individuals may be more motivated by impression management. This would be consistent with the patterns in our data, but a direct test of this idea remains a future goal.

Finally, we explored the social consequences of first impressions based on avatars, discovering that individuals who were more agreeable were more likely to create an avatar that others wanted to befriend. This result is consistent

with real-world findings where agreeable individuals are more likely to be selected as friends (Selfhout et al., 2010). It does, however, differ from a past study using social network photographs, in which target agreeableness was not a predictor of liking (Stopfer et al., 2013). It may be that agreeable people are able to craft likeable avatars but are less capable of creating or choosing likeable pictures of themselves. Although purely speculative, this may be because one has more control over one's appearance when customizing standardized avatars compared with the realm of photography.

We also found that individuals reporting an average personality (perceived as such by perceivers) created avatars that were more likely to elicit the desire to befriend in others. In addition, distinctive accuracy was not found to predict friendship intentions. Therefore, our data indicate that intentions to befriend individuals based on their avatar are most robustly determined by the degree to which the creator is seen as an average or normal person. The preference to befriend individuals who are perceived to be average might reflect our greater comfort pursuing friendships within our in-group (Jugert, Noack, & Rutland, 2011) or with those whose normativeness is perceived as an indicator of social adjustment (Furr, 2008).

Certain cues were also associated with friendship intentions, most notably having to do with the face and facial expression (e.g., eyes, mouth, hair, and head shape). This is consistent with past research using photographs: One factor that predicts liking at zero-acquaintance is a charming facial expression (Back, Schmukle, & Egloff, 2010). Perhaps related to the importance of these facial cues, accessories that blocked the face (i.e., hats and sunglasses) led to lower ratings of friendship intentions. (No other accessories covered the face.) Only one clothing item was positively correlated with friendship intentions: the wearing of a sweater. A purely speculative interpretation of these findings is that avatars that contain cues communicating warmth, be they through friendly facial expressions (e.g., smiling, open eyes) or perhaps metaphorically through their clothing (e.g., a cozy sweater), are more likely to elicit intentions to befriend in others. In contrast, choosing to customize one's avatar with accessories that conceal the face (e.g., sunglasses, hats) may come across as closed off or lacking in warmth, reducing this likelihood. This would be consistent with the fact that these cues were often related to perceived agreeableness, but it is a bit more difficult to theorize why these same cues also predicted perceived conscientiousness. In light of the large number of cues examined, these exploratory analyses should likely be interpreted cautiously and await replication.

We feel that further studies are needed to investigate the broader social outcomes of impression formation from avatars. To facilitate research into this topic, we have decided to release the full set of created avatars and associated personality and demographic data for the avatar creators (from Phase 1) to other researchers. This stimulus set should provide a helpful tool for future work and will be made available to researchers upon request to the first author.

Limitations

The current study is subject to a number of limitations. The avatars employed in this study were simple, two-dimensional, and static (Figure 1). In general, these types of avatars may be used by individuals in lieu of a real photograph on social networking profiles or instant messaging applications or in simple online social environments where the primary activities tend to be chat oriented. However, in many virtual environments such as online games, avatars are much more detailed, three dimensional, and move according to the wishes of the user. These dynamic avatars would also provide personality information in the form of behavioral residue (Gosling et al., 2002). It would be interesting to see if the results found here replicate with other forms of avatars, particularly because patterns of avatar behavior have been found to be associated with personality traits (Yee, Harris, Jabon, & Bailenson, 2011) and can be used to infer personality (Yee, Ducheneaut, Nelson, & Likarish, 2011). Furthermore, because the participants who created these avatars were not intending to keep or use them in any way, it is possible that they were less motivated to treat the process seriously compared with when they create avatars for use in their own lives. As a result, our findings are likely attenuated relative to phenomena associated with real-world avatar creation, exacerbating the possibility of false negatives. To counter this limitation in future studies, participants could be informed that they will be using their avatars for various interpersonal tasks. Doing so would allow researchers to examine how contextual pressures affect the created avatars and resultant accuracy in personality perception (e.g., Vasalou & Joinson, 2009). Additional personality data for avatar creators should also be collected in future studies to supplement self-reports, such as personality ratings from family members and peers (Vazire, 2006).

The avatar creators and perceivers who participated in this sample were drawn exclusively from a university participant pool. It is possible that the relatively young average age of our sample means that our participants were more familiar with both creating and assessing avatars than the general population. Therefore, our participants may have been more accurate in both conveying their personalities using avatars and predicting personality from avatars than might be expected in an older, general population sample. Replications using community samples may be informative in establishing the boundaries of accuracy in personality prediction from avatars.

A notable limitation of our study was that intentions to befriend were based on self-report and relied on a single-face valid item. To prevent participant fatigue in Phase 2, we employed brief measures of both personality and friendship intentions. As such, our findings with regard to friendship intentions should be interpreted with some caution. A future study should employ more realistic and behavior-based measures of friendship intentions, such as indicating a willingness to share one's email address with the avatar creator

or a desire to meet with the avatar creator in person. Furthermore, future studies should include a multi-item measure of friendship intentions to assess feelings of liking and desirability regarding the avatar creator.

Conclusion

Understanding impression formation in online environments is a timely and relevant undertaking, considering the rapid explosion of online interactions in recent years. It has even been suggested that meeting an individual online can be more informative than meeting that individual in person because of the wealth of information provided by personal webpages and/or social networking profiles (Gosling, Gaddis, & Vazire, 2007). The findings from this study suggest that we can use virtual proxies such as avatars to accurately infer personality information about others. Importantly, the impressions we make on others online may have an important impact on our real life, such as who becomes intrigued by the possibility of our friendship.

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Supplemental Material

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