Significance of Visual Realism – Eeriness, Credibility, and Persuasiveness of Virtual Influencers

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Abstract

Though human-like design can increase favorable social behaviors like familiarity and acceptance, it can also question the technology's effectiveness, rationality, and functionality. With capabilities that allow technology to become more and more human-like, researchers and practitioners continue to delve over the efficacy and deployment of humanness in design. In this research paper, we measure positive and negative perceptions towards different levels of humanness among an emerging form of digital character: the virtual influencer. In doing so, we assess the efficacy of human-like design among virtual influencers by manipulating their visual realism and measuring the effect of this manipulation on their credibility and persuasiveness. Our experimental design also allows us to explore the existence of the uncanny valley in a novel technological context.

Keywords: Visual realism, Human-likeness, Uncanny valley, Credibility, Persuasiveness

1. Introduction

Human-likeness in form (appearance) or function (behavior) of technology is often referred to as technology realism and is manifested in the way technology looks (visual realism) and the way it behaves (behavioral realism) (Kang & Watt, 2013; Duffy, 2003). Although adding humanlike design to technological interfaces increases social behaviors like familiarity and acceptance (Qiu & Benbasat, 2010; Nass, Steuer, & Tauber, 1994), it simultaneously raises questions about the effectiveness and functionality of the technology (Mosier, et al., 1998; Skitka, Mosier, & Burdick, 1999). How effectively do human-like features increase a system's efficiency in a given role? This study explores perceptions about the attractiveness, trustworthiness, expertise, and eeriness of virtual influencers based on independent variations in visual realism.

Virtual influencers (VIs) are computer-generated avatars on social media that project themselves as "virtual beings", "robots", and "aliens", but can look and behave less or very much like human beings (Nolan, 2018; Rogers & Cartano, 1962; Robinson, 2020). VIs are set to become the new form of native marketing tactic, influencing audience attitudes and behaviors with personal persuasiveness and frequent interaction (Freberg, Graham, McGaughey, & Freberg, 2011; Audrezet, Caffier de Kerviler, & Guidry Moulard, 2017). Several industry studies on VIs conclude that they have almost three times the engagement rate of online influencers (Marketing, 2020). There are about 300 VIs on Instagram alone, and they have doubled in size from 2021 (Travers, 2022).

The efficacy of VIs relies on the extent to which they can persuade users toward desired outcomes. This may depend partially on their appearance (Baylor, 2009). Visual representations can improve information transfer and can make a message more persuasive (Boyle, Anderson, & Newlands, 1994; Cesario & Higgins, 2008), and realistic design has been found to be more persuasive than that which is less realistic (Bailenson & Yee, 2005; Blascovich, et al., 2002). But results of experiments using less versus more humanlike representations in the form of stylized human characters have been mixed. For example, abstract-looking characters can be perceived as more credible and attractive than human-looking characters (Nowak, 2004), and computer characters can be more persuasive than a real person while simultaneously being perceived as less credible (Burgoon, et al., 2000). Thus, even with capabilities that allow the creation of very realistic avatars, researchers and practitioners continue to search for the optimum level of human-likeness that is acceptable to people.

In addition, comparison using very realistic characters like VIs is rarer, partially because of the evolving nature of natural face technology and the expertise involved to create digital characters. The inability to achieve high levels of realism has been found to violate users' expectations of what is "humanlike" and leads to feelings of eeriness and discomfort, making the character strange and unnerving (Mori, 1970). Characters that evoke feelings of eeriness for being almost but not completely realistic are said to

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fall into the uncanny valley, which is a place signifying low affinity to, and withdrawal from, technology (Mori, 1970; Seymour, Yuan, Dennis, & Riemer, 2021). Identifying designs that may lead to such feelings can save a massive amount of experimental money as well as user frustration. Concurrently, it can ease the introduction, acceptance, and utility of realistic interfaces in society.

To identify the optimum level of realism this paper seeks to test differences in user perceptions of eeriness, attractiveness, trustworthiness, and expertise of VIs that vary in visual realism. It also tests for differences in intention for desired behavior as a result of an endorsement by VIs. The paper answers the following research question:

- What is the optimum level of visual realism acceptable to people among realistic digital characters like VIs?
  - Does the uncanny valley (feelings of eeriness) exist for VIs? How does it affect perceived user perceptions of attractiveness, trustworthiness, and expertise of the VI, as well as intentional responses towards them?

To answer these questions, we conduct an online exploratory study to measure and compare perceptions of eeriness, credibility (attractiveness, trustworthiness, expertise), and willingness to comply with a VI (follow, share, donate) by manipulating visual realism (humanness) in VIs.

2. Visual Realism in Technology

Realism in technology refers to visual or behavioral realism, that is, visual or behavioral characteristics that are similar to human beings in appearance or behavior respectively (Duffy, 2003; Kang & Watt, 2013). Human beings are more likely to interact with technology that are more realistic than those that are not (Parise, Kiesler, Sproull, & Waters, 1999). This perspective is reinforced by the Computers as Social Actors (CASA) paradigm in IS, which states that human beings apply social rules to their interaction with computers as a response to a social situation (Nass & Moon, 2000; Nass, Steuer, & Tauber, 1994). CASA also dictates that this attribution of social rules is triggered by simplistic cues in systems or machines, like language and voice, and leads to familiarity and acceptance (Nass, Steuer, & Tauber, 1994; Lombard & Xu, 2021). It is this behavior that has led designers to believe that realism in technology can motivate and encourage use and acceptability.

Extant research suggests that presentational factors like appearance are more salient in determining social responses, at least in initial interactions (Garau, et al., 2003; MacDorman & Ishiguro, 2006). Furthermore, research also indicates that the level of human-likeness in appearance can dictate the acceptance or rejection of interaction with technology (Mori, 1970). Researchers have yet to conclude on the deployment of realism that is optimum for an interaction with human-like interfaces to produce desired outcomes. The evolving and advancing nature of technology, especially natural face technology, and changing user needs and expectations, complicate the research problem and demand further and continuous research in multiple contexts.

3. Visual Realism and Virtual Influencers

VIs take the roles of fashion models, political and environmental activists, chefs, travelers, gamers, aliens, and/or friends[1]. Their ultimate goal is to influence people's attitudes and behaviors towards an endorsed product, lifestyle, or cause. While many of them are popular, not all of them are uniform in their amount of humanlike appearance. Thus, some of them risk falling into the uncanny valley. Extant research has tested the presence of the uncanny valley to determine efficacy of human-like design for less realistic forms of avatars, robots, chatbots, and interfaces (Galanxhi & Nah, 2007; Khan & Sutcliffe, 2014), but VIs provide a unique context to study this phenomenon: One, VIs can exist in an advanced form of visual realism. Second, VIs are most prevalent on social media where people are interacting with them in real life just like they do with other social media "human" users. Furthermore, several VIs that do not appear to be very human-like and have the potential to fall into the uncanny valley, have a huge number of followers[2]. This puts the existence of the uncanny valley in novel technological contexts under speculation. Perhaps the prevalence of digital characters in traditionally human-only spaces is more acceptable now than it was in the past—may be people are used to interacting with less realistic forms of digital characters in the online space and do not find them uncanny anymore. This study takes the first step to understand, explore, and explain such speculations. Provided that the market size of digital humans, created with advanced natural face technology and artificial intelligence, is projected to reach USD 527.58 billion by 2030 from USD 10.03 billion in 2020 (Emergen, 2022), and companies are increasingly investing in creating digital humans for customer services (Bellan, 2022), it is

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[1] A repository of VIs can be found on www.virtualhumans.org
[2] Some cartoon-like influencers that have more than 100k followers can be viewed on the following links:

https://www.instagram.com/cfm_miku_official/
https://www.instagram.com/barbie/
https://www.instagram.com/anymalu_real/

essential for developers to understand and anticipate user response to such technological artifacts.

4. Visual Realism and Influence

People often draw inferences about superiority based on first encounters. For example, people tend to draw inferences about dominance based on height and facial attractiveness in real-life encounters (Yee, Bailenson, & Rickertsen, 2007). These physical attributes may have similar effects in the virtual world, and changes in the same may influence actions in the real world (Yee & Bailenson, 2007; Fox & Bailenson, 2009). Extant literature has established that physical appearance can influence persuasiveness in human-to-human communication (Boyle, Anderson, & Newlands, 1994). Similarly, provided that human beings treat human-like interfaces as social actors, visual realism of VIs can make them more or less influential in human-computer interaction.

The efficacy of VIs relies on the extent to which they can influence users to behave in a way that fulfills the objective of their designer. The source-credibility model builds on credibility as the main determinant of influence to provide a consistent and reliable framework for measuring the overall likelihood of a message receiver to modify attitudes or behaviors as encouraged or inspired by the message sender (Ohanian, 1990). Ohanian (1990) combines the most well-established dimensions of credibility—trustworthiness, attractiveness, and expertise—and provides a reliable blueprint for measuring them. Attractiveness refers to the likeability of a person's appearance; trustworthiness is the level of confidence the message receiver has in, or acceptance of, a message sender; expertise constitutes a message sender's level of knowledge about a topic of interest (Ohanian, 1990). The relationship between these constructs is multidimensional and all of them contribute towards an overall perception of credibility. However, each one can be measured and manipulated separately as well. The source-credibility model has been used extensively in the context of celebrity endorsement and social media influencers (Breves, Liebers, Abt, & Kunze, 2019), and the overarching evidence in these studies suggests that people are more likely to accept information from a source that is more credible.

In the context of social media, an influencer is conceptualized as an individual (VI) who has a combination of personal attributes (e.g., attractiveness) and network attributes (e.g., connectivity) that influence the perceptions of the user (e.g., Instagram user) (Bakshy, Hofman, Mason, & Watts, 2011). Personal and network attributes are the influencers' power resources, or raw material, to exert influence. But power resources exerted are not always perceived similarly by users (Scheer & Stern, 1992). Therefore, we propose that the realistic appearance of the VI (a power resource), and the extent of that, can lead to varying user perceptions, and in turn influencing effectiveness.

5. Hypotheses Development

Drawing from the Computer as Social Actors paradigm (Nass, Steuer, & Tauber, 1994), we assume that increase in visual realism in VIs will lead to more favorable responses. Realistic avatars are associated with increased credibility (Cowell & Stanney, 2005), and human-like images have been evaluated as the most attractive component in a computer interface (Walker, Sproull, & Subramani, 1994). Researchers have found positive evaluations for attractiveness (Nowak & Rauh, 2006; Castro-González, Admoni, & Scassellati, 2016), and trustworthiness (Gong, 2008; Seymour, Yuan, Dennis, & Riemer, 2021) for visually realistic characters.

But we also know that a less realistic human depiction is perceived as less credible than the source from which it is derived (Mori, 1970; McDonnell, Breidt, & Bülthoff, 2012). Extant research on the uncanny valley hypothesis with human-like technology design iterates one basic claim: nonhuman features deployed in more visually realistic characters are unsettling as compared to less visually realistic characters (Mori, 2017). The uncanny valley hypothesis explains that human-like characters that are not completely human-like or imperfectly realistic appear eerie and lead to withdrawal and unacceptance (Mori, 1970; Ho, MacDorman, & Pramono, 2008). Studies have demonstrated the existence of the uncanny valley in realistic rendering styles of computer-generated faces enabled by natural face technology and linked it to low appeal (McDonnell, Breidt, & Bülthoff, 2012). Early image morphing studies also provide evidence of the existence of the uncanny valley by measuring eeriness for a series of human-like robot images (Hanson, 2006; MacDorman & Ishiguro, 2006). We thus propose that even though the increase in visual realism of VIs may lead to more favorable reactions, imperfectly realistic VIs – visually realistic avatars that have nonhuman features or features that do not match humans perfectly – will be perceived as eerier as compared to less realistic and realistic VIs.

H1a: Imperfectly visually realistic VIs will evoke higher feelings of eeriness as compared to less visually realistic VIs.

H1b: Imperfectly visually realistic VIs will evoke higher feelings of eeriness as compared to visually realistic VIs.

Credibility is represented by the constructs attractiveness, trustworthiness, and expertise (Ohanian, 1990). Imperfect realism or eeriness in human-like digital characters is associated with negative user responses of low attractiveness (Schneider, Wang, & Yang, 2007), less familiarity (Tinwell, Grimshaw, & Williams, 2010), and lower likeability ratings (Mathur & Reichling, 2016). Imperfect realism can also negatively affect people's willingness to trust an entity and reduces the possibilities of friendship (Shin, Song, & Chock, 2019). People have been found to face difficulty in trusting robots that are hard to categorize as humans or nonhumans based on facial visual realism (Mathur & Reichling, 2016; Weisman & Peña, 2021). Extant literature also informs us that confusion in category identification can make it hard for people to make judgments about the expertise of an entity (Ho & MacDorman, 2010). Drawing from such evidence in extant literature we hypothesize that the same may be true in the context of VIs. We propose that imperfect VIs that have the potential to fall into the uncanny valley will be perceived as least credible (attractive, trustworthy, expert) among all human-like VIs.

H2a: Imperfectly visually realistic VIs are perceived to be less attractive than less visually realistic and visually realistic VIs.

H2b: Imperfectly visually realistic VIs are perceived to be less trustworthy than less visually realistic and visually realistic VIs.

H2c: Imperfectly visually realistic VIs are perceived to be less expert than less visually realistic and visually realistic VIs.

Attitudes or perceptions formed by people should lead to consequential behavior (Ajzen, 2005). Provided that imperfectly realistic VIs are rated as more eerie than less realistic and realistic VIs, and that increase in eeriness ratings is affiliated with a decrease in credibility perceptions as well as withdrawal from technology/interface, we hypothesize that imperfect VIs will not be able to fulfill the objectives of their designer or company, i.e., they will be less persuasive than less visually realistic and visually realistic VIs.

In the context of social media, particularly Instagram, two types of performance outcomes can be highlighted in the consumer behavior literature: social, which have to do with activities typical to social media like commenting, following, and sharing, and nonsocial, which is related to intentions to purchase or donating behavior (Katsikeas, Morgan, Leonidou, & Hult, 2016). For the purpose of our study, we focus on three specific action outcomes related to persuasiveness: (1) following: liking the cause endorsed by him/her, (2) sharing: spreading word-of-mouth about the information endorsed by him/her, and (3) donating: acting upon the appeal made by the influencer. Given

our understanding of the uncanny valley hypothesis, and the effects of eeriness, we hypothesize that people are less likely to be persuaded by a VI that is imperfectly realistic (uncanny), and are hence less likely to follow, share, or donate to, their appeal.

H3a: People are less likely to follow information endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.

H3b: People are less likely to share information endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.

H3c: People are less likely to donate to a cause endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.

6. Methodology

This study is a factorial experiment, where different levels of visual realism are compared for eeriness, credibility (attractiveness, trustworthiness, expertise), and persuasiveness. A pretest with 145 US residents, who were above 18 years of age and had a social media account, was conducted to identify levels of differential humanness. Amazon Turk was used to recruit the participants and Qualtrics was used to collect the data. A list of 185 human-like VIs was drawn from virtualhumans.org. Out of these, discontinued and private accounts, those that represented a particular brand or appeared to be animal-like, things, alien, or robotic, as well as others that appeared to evoke feelings of eeriness for reasons other than humanness (e.g., green hair, different colored eyes, and pink skin color) were removed from the analysis. The selection was controlled for country and race to avoid bias from differences in facial features. From the accounts that were left, only those that had enough pictures of clear faces to be shown to participants were selected for the analysis. These included 8 male VIs and 23 females. The research team selected 3 pictures for each VI to be shown to the participants. The pictures were chosen carefully to present a range of expressions, clothes, and neutral backgrounds. Participants looked at each VI (represented by 3 pictures) in a random order and rated the VIs for humanness on a 5-item scale provided by Ho and MacDorman (2010) ($\alpha = 0.92$). Each participant thus rated 31 VIs for humanness. A repeated-measures ANOVA with a Greenhouse-Geisser correction determined that mean humanness differed between the VIs ($F(10.857, 1563.432) = 89.677$, $p = 0.000$).

Next, we ordered the VIs for mean humanness and found a range of 1.368 to 4.622 on a 7-point Likert scale. From this range, we created four categories of

humanness (1-2, 2.1-3, 3.1-4, 4.1-5). We did this to accommodate all possible levels of differences in human likeness to determine the optimum level for our outcome variables. We then ran a post hoc analysis for pairwise comparisons with a Bonferroni adjustment. This enabled us to randomly select two VIs for each level: VIs were nonsignificant for humanness within the level, but significant between levels. We choose 2 VIs for each level for robustness. We only chose female VIs because there were no male influencers in the last category. This also helped us control our analysis for gender.

For the main study, 623 US residents, proficient in English, with a social media account, were recruited on Amazon Turk and were shown 3 pictures of a VI representing one level of humanness in an online questionnaire[3]. Participants took part in the study for a $0.50 compensation. They were asked to rate the presented VI for humanness (Ho & MacDorman, 2010), eeriness (Ho & MacDorman, 2010) and credibility dimensions (Ohanian, 1990). Pictures were shown at the same time, like an Instagram newsfeed. Persuasiveness was measured by asking the participants if they would like to follow, share, or donate to the VI as a result of a textual appeal[4] supporting the awareness and eradication of anemia (Kim & Johnson, 2016). The appeal was kept consistent in all experimental groups.

The experimental manipulation involved the different levels of humanness. Differential humanness was confirmed by the pretest, and by a manipulation check. Participants were asked to select a category for the shown VI: Cartoon (Level 1), Imperfect Human (Level 2), Human-like (Level 3), Human (Level 4). The manipulation check category matched the level of human likeness to which the influencer was designated. An analysis of variance confirmed differential humanness across levels (F_{Welch} (3, 274.249) = 26.834, p < 0.001). All four levels, from 1 to 4, showed an increasing trend in humanness, but the Games-Howell comparisons indicated that Level 3 was not significantly different from Level 4. This does not pose a threat to the analysis as we still had three levels to assess the existence of the uncanny valley and detect differences in perceptions and actions with respect to increasing humanness. For parsimony and power, we randomly select two influencers from Levels 3 and 4 for further analysis. We do this to avoid having sample sizes that are too different from each other (Keppel, 1993). Although there is no good of rule of thumb for how unequal the sample sizes need to be for heterogeneity of variances to be a problem, analysis of variance is considered robust for only small departures in sample sizes (Keppel, 1993). The final set of VIs for the

analysis are shown in Figure 1. The final dataset used for analysis has 368 observations.
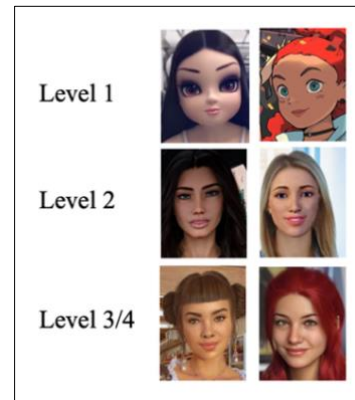

Figure 1: VIs for Analysis

7. Analysis and Results

Data was collected in January 2022. The final count of people that made valid observations was 368 (n = 181; 49.2% females). The age of most of the participants was 18-40 years (n = 260; 70.7%). More than half of the participants (n = 225; 61.1%) of the participants followed some VI, however, none of them followed the influencer shown in the study. All the participants reported using Instagram. SPSS was used for analysis. Tests statistics were interpreted with a significance threshold of α = .05. Tests of multivariate models used the F value of Pillai's trace for robustness (Field, 2013). Effect sizes for statistically significant manipulations were calculated using partial η^2 (ηp2) and interpreted according to the following thresholds: small = 0.01, medium = 0.06, and large = 0.14 (Cohen, 1973).

The three levels of humanness showed significant differential humanness. Humanness was measured using the 5-item, 7-point Likert scale by Ho and MacDorman (2010), α = 0.926. Mean differences in humanness between the groups were significant (F_{Welch} (2, 245.289) = 19.275, p < 0.001). The Games-Howell multiple comparisons indicate that Level 1, 2, and 3 are significantly different for increasing levels of humanness from Level 1 to 3. To minimize Type I error inflation from multiple comparisons, MANCOVA was performed. The results support the main effects of visual realism (F(8, 720) = 5.673, p < 0.001, ηp2 = 0.059). The main effect of visual realism on eeriness is small and significant (F(2, 362) = 5.269, p = 0.006, ηp2 = 0.028). The main effect of visual realism on overall credibility seems to be medium and significant: attractiveness (F(2, 362) = 13.021, p < 0.001, ηp2 = 0.067), trustworthiness (F(2, 362) = 10.973, p < 0.001, ηp2 = 0.057), expertise

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[3] Can be made available upon request.

[4] Can be made available upon request.

(F(2, 362) = 5.350, p = 0.005, ηp2 = 0.029). Posthoc analysis with pairwise comparisons presents that VIs that are imperfectly realistic are perceived to be eerier than less visually realistic VIs (Mean difference= 0.459, p = 0.004), supporting H1a. Imperfect VIs are also perceived to be eerier than more realistic VIs but this difference is not significant (Mean difference = 0.178, p = 0.427), failing to support H1b. The results suggest that although the uncanny valley might still exist among visually realistic characters it is not deep enough to be significant for differences between imperfect and realistic VIs. Nevertheless, our results ascertain that less realistic digital characters with the least amount of human-likeness are perceived to be the least eerie.

Although we did not see a significant uncanny valley effect in perceptions of eeriness, we were able to see some effects of the uncanny valley in other dependent variables. Imperfect VIs were perceived to be the least attractive (m = 3.775), trustworthy (m = 3.659), and expert (m = 3.792) among the three levels of realism. Imperfect VIs were less attractive than less realistic (Mean difference = -0.537, p = 0.009), and realistic VIs (Mean difference = -0.908, p < 0.001). This result support H2a. Imperfect VIs were also perceived to be less trustworthy than less realistic (Mean difference = -0.554, p = 0.004), and realistic VIs (Mean difference = -0.787, p < 0.001), supporting H2b. Lastly, imperfect VIs were rated as less experts as compared to less realistic, but this difference was not significant (Mean difference = -0.246, p = 0.380). The difference in perceived expertise was significant for the difference between imperfectly realistic and realistic VIs (Mean difference = -0.616, p = 0.003). These results partially support H2c. Running the model with a credibility index (a mean of the constructs: attractiveness, trustworthiness, expertise) gives similar results[5].

We use direct measures to inquire about people's willingness to follow the influencer or share and donate to the cause endorsed by the influencer. The results of a crosstabulation analysis indicate that imperfectly realistic VIs are the least persuasive: follow 82%; share 82%, donate 77%. The crosstabulations also indicate that information endorsed by a less realistic VI is most likely to be followed (96.7%), shared (94.3%), and donated to (88.6%). To detect significance among the differences in persuasive outcomes, we conduct a binomial logistic regression to determine the odds of following, sharing, and donating behaviors for differences in humanness. Three separate models with following, sharing, and donating outcomes as dependent variables were run. Level 2 (imperfectly realistic) was made the indicator category. Realism (levels of humanness) was the independent variable. Eeriness,

attractiveness, trustworthiness, expertise, VI-user entity similarity, donating behavior, anemia affiliation, Instagram likeability, animation familiarity, gender and age were included as control variables.

The first model with "Follow" as the dependent variable was statistically significant (χ2(13) = 52.459, p < 0.001) and explained 26.4% (Nagelkerke R2) of the variance in the odds of following or not following a VI. The Hosmer and Lemeshow test confirms that the data fits the model well (χ2(8) = 3.843, p = 0.871). The model correctly classifies 90.02% of cases overall. 99.4% of participants who showed a willingness to follow the VI were also predicted by the model to show a willingness to follow the VIs. 17.1% of the participants who did not want to follow the influencer were correctly predicted by the model to not show a willingness to follow the VI. The Wald test indicates that less realistic VIs (p < 0.001), imperfect VIs (p < 0.001), and anemia affiliation (p = 0.002), added significantly to the model. The results indicate that the odds of following a less realistic VI are 12.8 times higher as compared to the imperfect VI. Although realistic influencers are also 1.75 times more likely to be followed as compared to imperfect VIs, this result is not statistically significant. We thus partially accept H3a.

The second model with "Share" as the dependent variable was also statistically significant (χ2(13) = 36.959, p < 0.001) and explained 19% (Nagelkerke R2) of the variance in the odds of sharing or not sharing information endorsed by a VI. The Hosmer and Lemeshow test confirms that the data fits the model well (χ2(8) = 7.546, p = 0.479). The model correctly classifies 89.4% of cases overall. 100% of participants who showed a willingness to share information endorsed by the VI were also predicted by the model to show a willingness to share information endorsed by the VI. 4.9% of the participants who did not want to share information given by the VI were correctly predicted by the model to not show a willingness to share information endorsed by the VI. The Wald test indicates that less realistic VIs (p < 0.001), imperfect VIs (p = 0.003), realistic VIs (p = 0.058), and anemia affiliation (p = 0.026), added significantly to the model. The results indicate that the odds of sharing information endorsed by a less realistic VI are 5.875 times higher as compared to the imperfect VI. We also observe that the odds of sharing information endorsed by a realistic influencer are 2.265 times higher as compared to an imperfect influencer. Our results support H3b.

The third model with "Donate" as the dependent variable was statistically significant (χ2(13) = 36.815, p < 0.001) and explained 15.7% (Nagelkerke R2) of the variance in the odds of donating or not donating to the

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[5] Can be made available upon request.

cause endorsed by a VI. The Hosmer and Lemeshow test confirms that the data fits the model well ($\chi2(8) = 13.781$, p = 0.088). The model correctly classifies 83.2% of cases overall. 99% of participants who showed a willingness to donate to the cause endorsed by the VI were also predicted by the model to show a willingness to donate. 9.2% of the participants who did not want to donate to the cause endorsed by the VI were correctly predicted by the model to not show a willingness to donate. The Wald test indicates that less realistic VIs (p = 0.011), imperfect VIs (p = 0.031), anemia affiliation (p = 0.004), and age (p = 0.046) added significantly to the model. The results indicate that the odds of donating

to a cause endorsed by a less realistic VI are 2.7 times higher as compared to the imperfect VI. The odds of donating to a realistic VI are also 1.19 times higher as compared to an imperfect VI, but this result is not significant. Our results partially support H3c.

We ran logistic regression with similar dependent variables (follow/share/donate) with the credibility index as the independent variable along with the control variables. Results were similar[6]. Less realistic VIs were significantly more likely to be followed, shared, and donated to as compared to imperfect VIs. A summary of results is provided in Table 1.

Table 1: Summary of Hypotheses and Results

Hypothesis	Result
H1a: Imperfectly visually realistic VIs will evoke higher feelings of eeriness as compared to less visually realistic VIs.	**Supported**
H1b: Imperfectly visually realistic VIs will evoke higher feelings of eeriness as compared to visually realistic VIs.	**Not significant**
H2a: Imperfectly visually realistic VIs are perceived to be less attractive than less visually realistic and visually realistic VIs.	**Supported**
H2b: Imperfectly visually realistic VIs are perceived to be less trustworthy than less visually realistic and visually realistic VIs.	**Supported**
H2c: Imperfectly visually realistic VIs are perceived to be less expert than less visually realistic and visually realistic VIs.	**Partially supported** *Significant for comparison with realistic VIs; Not significant for comparison with less realistic VIs*
H3a: People are less likely to follow information endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.	**Partially supported** *Significant for comparison with less realistic VIs; Not significant for comparison with realistic VIs*
H3b: People are less likely to share information endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.	**Supported**
H3c: People are less likely to donate to a cause endorsed by an imperfectly visually realistic VI as compared to a less visually realistic and visually realistic VI.	**Partially supported** *Significant for comparison with less realistic VIs Not significant for comparison with realistic VIs*

8. Discussion

The study's aim was to explore the efficacy of human-like design and the optimum level of humanness acceptable in digital characters. We used an online experiment to detect the presence of the uncanny valley among human-like VIs and determine their credibility perceptions that may lead to persuasiveness. Overall, the results leaned in favor of the existence of the uncanny valley, suggesting that imperfectly realistic VIs should be avoided by developers. Imperfect VIs were perceived to be the least attractive, trustworthy, and expert, and were significantly less attractive and trustworthy than less realistic and realistic VIs. They were also perceived to be less expert than realistic VIs. Our findings suggest that the speculation about the nonexistence of the uncanny valley does not hold true. However, it needs further support about its depth and significance when imperfect VIs are compared to realistic VIs. Furthermore, the results, especially the nonsignificant

H1b, hint upon the fact that eeriness may not be a reliable measure to determine the existence of the uncanny valley. People may not find imperfect digital characters eerie as compared to realistic VIs, but certainly do not consider them credible. Thus the uncanny valley, which may not be visible with respect to eeriness perceptions, can be found from perceptions about attractiveness, which is reliably used as a measure to determine the existence of the uncanny valley in extant research (MacDorman, Green, Ho, & Koch, 2009; MacDorman & Entezari, 2015).

For persuasiveness, we found that imperfect VIs were less likely to be followed, shared, and donated to, when compared to less realistic VIs. We also found that they were less likely to be shared as compared to realistic VIs. The results show that less realistic VIs have the most appeal when it comes to intention to behave. In all cases, less realistic VIs were most likely to be followed, shared, and donated to. These results present a case for the development and deployment of less realistic avatars for persuasiveness in the digital

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[6] Can be made available upon request

context. They also present a departure from expectations of consequential behavior from attitude. While realistic VIs are perceived to be the most credible, when it comes to intention to act, less realistic VIs may be more successful in fulfilling an organization's goals from persuasive appeals. This could be because of the blurring line between who is human and what is human-like. Realistic technology may appear to be as credible as real people, but the skepticism around online transparency (Galanxhi & Nah, 2007) as well as the threat to human distinctiveness (Ferrari, Paladino, & Jetten, 2016) may not allow people to trust them enough to change behavior.

Lastly our results fail to explain the alarming popularity of some imperfect VIs on digital media. On exploring the uncanny valley literature further, we suggest that this may be because of a sense of curiosity and interest evoked by such characters (Maheswaran & Chaiken., 1991). This explanation, however, needs to be explored and tested further in our context.

In summary, the study explains that low credibility perceptions of uncanny digital characters can lead to unfavorable perceptual outcomes even if no significant eeriness perceptions are found. This means that uncanny valley may be manifested in other response variables other than eeriness. In all cases, the safest characters for persuasive appeals seem to be less realistic digital characters.

9. Implications and Future Research

The findings present IS researchers with new avenues of research relating to the acceptability of less realistic digital characters as compared to realistic counterparts and the narrowing of the uncanny valley in novel technological contexts. The next step perhaps is to test and validate the preference of less realistic digital characters over realistic characters.

For practitioners, the study ascertains that human-like design with nonhuman or out-of-proportion human-like components, can lead to unfavorable user reactions owing to the presence of the uncanny valley. Visual design that replicates human beings, or clearly does not do so, is favorable for technology acceptance and utility. Moreover, we build a case for the development of less realistic digital characters as compared to realistic versions from evidence of our logistic models.

Future research can improve the research model and replicate findings in other contexts so that the effects of human-like visual design on decisions can be traced more vividly. Along with manipulating design, manipulating credibility for influencers having the same level of humanness can help validate the

results of this study. Future research can employ a methodology that measures persuasiveness by actual behavior instead of intentions. Such endeavors can strengthen our case for less realistic designs.

10. Limitations

Some limitations must be mentioned to rationally interpret the findings. Overreporting and misreporting of self-reported measures like those used for persuasiveness can be a threat to validity. Although subjective effects can be larger than other kinds of effects (Yee & Bailenson, 2007), a design that measures actual behavior would provide more valid results. Although we employed manipulations from a range of VIs, the generalizability of the results can be threatened by the unique context. Although VIs are not restricted to just Instagram and can be found all over social media, a study employing digital characters from a range of contexts can validate and increase generalizability. Another limitation of the study is the use of 3 pictures for each VI. Although efforts were made to control bias from expressions, backgrounds, clothes etc., a field experiment showing actual accounts can strengthen the findings from our study.

11. Conclusion

The paper identifies that less realistic digital characters are the most effective in fulfilling persuasive goals in an online setting. Results from an online experiment suggest that people do not necessarily perceive uncanny characters as eerie but do perceive them to be less credible (attractive, trustworthy credible) leading to less favorable social behaviors and low compliance. The paper finds possibilities of the diminishing significance of the uncanny valley as characterized by eeriness, suggesting that people are well-accustomed to all kinds of human-like characters in the digital space and do not find them eerie anymore, but will still find those that are not uncanny to be more credible and persuasive than those that are imperfect.

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