

Credibility of Virtual Influencers: The Role of Design Stimuli, Knowledge Cues, and User Disposition

Samia Cornelius
University of Michigan
samiaco@umich.edu

Dorothy E Leidner
University of Virginia
dleidner@att.net

Hind Benbya
Deakin University
h.benbya@deakin.edu.au

Abstract

Virtual Influencers (VIs) are digital influencers that can look and behave like human beings but project themselves as “robots”. They influence people’s attitudes and behaviors through their presence and interaction. While human-like design can lead to acceptance, additional information about machine-like description (robot) can create conflict about the influencer’s identity and lead to unfavorable social responses. Social perceptions are also subjective. In this study, we examine the influence of human-like design, knowledge cues, and user disposition on user perceptions of VI credibility. In doing so, we present a case for the substitution of human influencers by “lesser human” counterparts in the context of social media.

Keywords: Virtual influencers, Credibility, Humanness, Knowledge, Disposition

1. Introduction

Advancements in natural face technology and natural language processing have enabled virtual images and avatars to become more human-like in appearance. One novel application of such technological advancement is the virtual influencer (VI). These are avatars that look and behave like human beings and influence people’s opinions, attitudes, and behaviors through their presence and interaction (Nolan, 2018). But while VIs can appear to be more or less human-like, they identify as being “robots,” “virtual,” “digital characters,” or “alien.” Their real identities are rarely known to the users, and yet they attract a considerable number of followers in the digital space. They are also known to have engagement rates, double that of traditional influencers (Marketing, 2020).

Extant literature provides mixed evidence about the potential of human-like technology. While congruence between human-like appearance and behavior may lead to familiarity and acceptance (Nass & Moon, 2000; Nass, Steuer, & Tauber, 1994), it can also lead to deception and a decrease in identification (Galanzhi & Nah, 2007; Nowak, 2013). Furthermore, the mismatch

between the apparent “robot” description (knowledge cues) and human-like appearance and behavior (design cues) can lead to confusion and withdrawal (Skitka, Mosier, & Burdick, 1999; Kätsyri, Förger, Mäkäräinen, & Takala, 2015). VIs have soared in popularity in recent years as their adoption across industries in the social media space has increased, making such digital influencers potential substitutes for traditional human roles on social media (Marketing, 2020; Travers, 2022). Despite their increasing popularity, equivocal evidence about the implications and the potential of VI remains.

Our paper examines user perceptions of the credibility of VIs by investigating three dimensions: design stimulus, knowledge cues, and user disposition. While design and knowledge cues form the basis of first impressions, users’ perceptions are not only based on such external stimuli but also on the user’s disposition (Epley, Waytz, & Cacioppo, 2007; Bandura & Walters, 1977). Hence, we also examine if user disposition can play a role in shaping social perceptions of VIs. To our knowledge, no study has studied the shaping of social perceptions based on design and knowledge cues to humanness, and we take this step by measuring user perceptions of VI’s credibility in a digital environment.

The efficacy of VI depends 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 primary 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 inspired by the message sender (Ohanian, 1990; Erdogan, 1999; Mishra, Roy, & Bailey, 2015). Using this model, we rely on two online experiments to determine the effectiveness of VIs perceived as a result of design, knowledge, and user disposition. We answer the following research questions:

- How does an increase in human-like design (*design stimuli*) impact user perceptions of credibility among VIs?
- How do dispositional characteristics (*subjective evaluations*) and knowledge cues (*additional information*) about *more* versus

less human-like VIs impact user credibility perceptions?

- What is the relation between design stimuli, knowledge cues, and dispositional characteristics in determining credibility perceptions of VIs?

We first explain our three primary constructs (design, knowledge, and disposition) and their relationship to credibility perceptions of VIs. We then formulate and present our hypotheses followed by our empirical analysis and findings.

2. Design Stimuli

The ability to socially perceive similar faces and movements occurs almost immediately after birth, developing over time to become a sensitive cognitive ability to differentiate between agents with psychological states (humans) and physical objects (Sanefuji, 2008; Poulin-Dubois, 1999). Drawing from this literature, the like-me hypothesis states that detecting and understanding the similarity between self and others forms the basis of social cognition (Meltzoff, 2007). It suggests that the detection and recognition of human-like artificial agents as humans could lead to persuasion that is equivalent to an interaction with a human influencer on social media, simply because users find them similar to themselves in terms of basic physical morphology. For example, Gong (2008) manipulates facial characteristics of interface agents to depict human, robot, or humanoid appearances and finds that more human-like interfaces lead to a higher degree of social responses of social judgment, homophily perceptions of the agent, conformity in decision-making, competency, and trustworthiness. Similarly, MacDorman (2019), in his study of real versus animated digital agents with variation in voice, prosody, facial expressions, and body movement found human-like appearances to be supportive of enjoyment and persuasion. Thus, human beings respond positively to technology that possesses characteristics congruent to the positive human schema (Kim & McGill, 2011).

The ability to detect familiarity and find congruency is facilitated by a process called anthropomorphism, in which users attribute human-like characteristics to nonhuman entities that possess human characteristics, motivation, attitudes, and behaviors (Epley, Waytz, & Cacioppo, 2007). Technological agents on social media are typically imbued with various combinations of human-like design, such as human-like faces, bodies, and expressions, to allow the easy access and activation of human-like knowledge representations in the brain. Therefore, human-like design is referred to as a situational catalyst for anthropomorphism (Epley, Waytz, & Cacioppo, 2007).

Extant literature has provided support for positive social responses to human-like design in technology, reinforcing the stance presented by the “like-me” hypothesis. For example, Kang and Watt (2013) find that anthropomorphism of human-like avatars is particularly important for communication satisfaction, and Nowak (2013) finds that anthropomorphic buddy icons are more relatable in terms of similarity to and identification with self.

Overall, this research stream suggests that attribution of human-like characteristics from human-like design stimuli can lead to persuasion that is equivalent to an interaction with a human influencer on social media. However, most human-like agents are not entirely human-like in appearance and behavior. Some digital agents are only partially human, while others are more machinelike in appearance. To these, people attribute lesser human characteristics as compared to those that are more fully human-like (Epley, Waytz, & Cacioppo, 2007). This is because alternate cognitive representations, other than human-like cognitive representations, are activated in the human brain. The application of cognitive representations is then dependent on the integration of cognitive representations. This integration depends on not only design stimulus but other factors like knowledge about the nonhuman entity and the disposition of the user (Epley, Waytz, & Cacioppo, 2007). Nevertheless, this line of research highlights the variation in user response based on the design stimuli of an agent. It also provides evidence about more human-like attribution to more human-like design and vice versa. It hints at other factors that may influence variation in user response but does not provide any insight about which factor can override the other under what circumstances. In this paper, we study the impact of knowledge cues and disposition on user response to design, as well as the interaction amongst them to determine which factors have the potential to override others in the context of persuasion.

3. Knowledge Cues

Human-like agents are considered “like-me” or humans for technology design and can thus lead to persuasion through anthropomorphism. But what happens when knowledge cues about the agent’s identity activate an opposing set of cognitive representations in the human brain? VIs project themselves as “robots,” “digital characters,” “virtual beings,” or “aliens.” This information can lead to confusion and withdrawal due to a mismatch between their human-like design and machinelike identity (Kätsyri, Förger, Mäkäriäinen, & Takala, 2015). This phenomenon has been explained in the extant literature

as a reason for withdrawal from characters that appear human-like but *not completely so* (Mori, 1970; Kätsyri, Förger, Mäkäräinen, & Takala, 2015). Authors have suggested that mismatch or inconsistency between human-like design cues at different levels of human-likeness can lead to a lack of familiarity and likeability (MacDorman, Green, Ho, & Koch, 2009; Pollick, 2009). Rigid and mechanical movement by a human-like agent is an example of such inconsistency (Pollick, 2009; Cowan, Branigan, Obregon, Bugis, & Beale, 2015).

Extant research has also provided evidence on the detrimental impact of perceptual mismatch on persuasion. Sharma and Stafford (2000) observe the effect in a retail atmosphere. They find that when people's expectation of the salespeople's availability does not match the atmosphere of the store, persuasion of the salespeople is negatively affected. They further suggest that a mismatch between the store's ambiance and salespeople's availability degrades the impact of credibility generated from store design. Consistency in animation and recorded voice has been shown to increase credibility perceptions of digital agents (Parmar, Olafsson, Utami, Murali, & Bickmore, 2022). And human-likeness in technology is found to enhance human-like trust in technology performing a human task, suggesting that human-like design and machine-like functions may not lead to perceptions of trustworthiness (Lankton, McKnight, & Tripp, 2015).

We extend the notion of perceptual mismatch in design cues to suggest that inconsistency between design stimulus and knowledge cues can also lead to perceptual mismatch and resulting withdrawal from technology. Hence, knowledge cues about the identity of an agent can change default social perceptions from design stimuli. For example, if you know that the lion in the circus is actually a human being dressed in the costume of a lion, your perception of the social environment will be completely different from what it was without knowing this fact. Therefore, we posit that interactional outcomes, or persuasion in the context of VIs, depend not only on design stimuli but also on knowledge cues.

4. Disposition

Even if design similarity motivates compliance, individual differences in capabilities to believe or attribute information can change perceptions (Epley, Waytz, & Cacioppo, 2007). According to the three-factor theory of anthropomorphism, perceptions associated with human-like agents can vary based on accessibility of cognitive representations and the users' dispositional characteristics *need for cognition* and *loneliness* (Epley, Waytz, & Cacioppo, 2007). According to the theory, realistic design may serve as a

situational catalyst to access and activate human-like cognitive representations in the brain, but their application to the target may depend on the user's need for cognition and loneliness. Need for cognition is the tendency to engage in and enjoy effortful thinking, and loneliness refers to feelings of isolation or the need to connect with others.

Epley and colleagues (2007) propose that people who have a high need for cognition do not completely rely on human-like design cues for attribution. They indulge in effortful thinking and rely on alternate information to make judgments. Since VIs look like humans but project themselves as robots, users may activate both human-like and machinelike cognitive representations in their brains. And since they rely less on design cues, they are more likely to consider knowledge cues for attribution to the target. Hence, they attribute human-like characteristics (from design) less than people who have a low need for cognition. In other words, they anthropomorphize less. As for people who feel socially isolated, Epley and colleagues (2007) explain that lonely people are more likely to rely on readily accessible cues to access and apply cognitive representation for building relationships with nonhuman objects. Therefore, in the presence of human-like design cues, they quickly activate and attribute human-like cognitive representations to the target to satisfy their need to connect. Hence, lonely people will make more human-like attributions as compared to those who are not lonely.

We can thus summarize that people with a high need for cognition rely more on knowledge cues to make attributional responses as compared to those who have a low need for cognition. And lonely people are more likely to rely on design cues for interactional responses as compared to those who are not.

5. Hypotheses Development

Extant literature provides contrasting evidence about the efficacy of more human-like or less human-like design in technology. To help explain some of this inconsistency, we propose that social responses to human-like technology, particularly in the case of persuasion, are dependent on design stimuli, knowledge cues, and user disposition. Ignoring any of the three will provide results that lack reliability. While we do not claim that these are the only factors that shape user responses, we ascertain that they have not been studied in previous studies. In addition, no study has explored credibility perceptions as a response variable to design stimuli, knowledge cues, and dispositional characteristics. Figure 1 presents our research model.

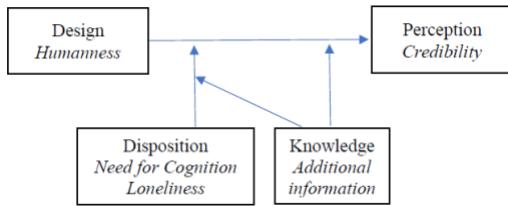


Figure 1. Research Model

In the context of persuasion, the perceived credibility of a message source is an important cue that influences the effectiveness of an appeal (Ohanian, 1990). Research in the past has shown that highly credible spokespersons generate higher acceptability of their ideas than those with low credibility (Sternthal, Phillips, & Dholakia, 1978). The source-credibility model by Ohanian (1990) presents three dimensions of source credibility: perceived attractiveness, trustworthiness, and expertise. 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. The relationship between these constructs is multidimensional, and all of them combine to produce an overall perception of the credibility of a message sender. As the model presents, people's subjective perceptions of credibility are a vital constituent of the persuasion process.

Human-like VIs with a high degree of humanness in appearance may elicit the same responses as traditional human influencers (Meltzoff, 2007; Nass, Steuer, & Tauber, 1994). While the theory of anthropomorphism supports favorable responses to human-like design, it also explains that user disposition (need for cognition and loneliness) can change social perceptions of human-like design (Epley, Waytz, & Cacioppo, 2007). People with a high need for cognition rely less on design cues: they tend to think more and evaluate them carefully before developing perceptions. These people actively overcome readily accessible defaults in judgment from readily available cues (appearance) and correct them with the help of knowledge cues before applying them to an entity (Cacioppo, Petty, Feinstein, & Jarvis, 1996; D'Agostino & Fincher-Kiefer, 1992; Epley & Gilovich, 2005). They generally are hence less likely to rely on people just based on accessible cues and so less likely to trust them as a message source. Critically, considering that human-like VIs look very similar to human beings, we can assume that the tendency to not rely on people without additional information will merely transfer to the realm of VIs. In such a case, VIs that appear to be "less human" will be perceived as more credible and hence more persuasive. We propose that, considering that

human-like VIs will be treated like other humans and less human-like VIs will be regarded as less human, the tendency to not rely on others without knowledge cues will be transferred to a lesser degree to less human-like VIs as compared to those that are similar to human beings in design. In other words, the tendency to not rely on other humans transfers to human-like VIs, because of their similarity to human beings. So, people will find the less human VI to be more credible as compared to the human-like one.

H1a: In the absence of knowledge cues, people with a high need for cognition (versus low) will perceive less human-like VIs to be more persuasive as compared to human-like VIs.

Establishing and maintaining social connections is a basic human need and can have strong negative implications when thwarted (Baumeister & Leary, 1995). Depriving people of social connections can cause hurt and leads them to actively search for effective ways to alleviate that hurt (MacDonald & Leary, 2005). People experiencing such hurt spontaneously imagine social relationships (Twenge, Catanese, & Baumeister, 2003), focus their attention on social cues (Gardner, Pickett, Jefferis, & Knowles, 2005), and seek new contacts with other people (Maner, DeWall, Baumeister, & Schaller, 2007). It increases the baseline accessibility of human-like cognitive representations in the brain (Gardner, Pickett, Jefferis, & Knowles, 2005), thereby increasing the tendency to perceive human-like characteristics in nonhuman agents. In the context of anthropomorphism, this pattern has been appropriated to pets and religious agents (Epley, Waytz, & Cacioppo, 2007). Extending this pattern to VIs, we deduce that lonely people will seek the same social connection in human-like VIs as in humans. Therefore, they will treat human-like VIs the same way as other human beings. Design stimuli are enough to develop perceptions for such people because they fulfill their objective of developing connections and relationships.

Provided that lonely people seek the same connections in the digital world that they seek in the real world, they are more likely to find the human-like VIs more persuasive than the less human-like ones. Although, as explained earlier, they are likely to anthropomorphize all nonhuman entities, given the "like me" hypothesis (Meltzoff, 2007), computers as social actors paradigm (Nass, Steuer, & Tauber, 1994), and the three-factor theory of anthropomorphism (Epley, Waytz, & Cacioppo, 2007), they are more likely to have more favorable responses to human-like VIs as compared to their less human-like counterparts.

H1b: In the absence of knowledge cues, lonely people (versus not) will perceive human-like VIs to be more persuasive as compared to less human-like VIs.

Provided that people with a high need for cognition will find less human-like VIs to be more credible, we propose that lonely people with a high need for cognition will prefer to interact and socialize with less human-like VIs as compared to those that are more human-like and find them more persuasive. This is because lonely people tend to anthropomorphize both human-like and less human-like VIs in the same way to build connections. However, need for cognition inculcates a sense of preference among them to choose one over the other. Hence, we hypothesize that lonely people with a high need for cognition will prefer to build connections with less human-like VIs as compared to human-like VIs.

H1c: In the absence of knowledge cues, lonely people with a high need for cognition will perceive less human-like VIs to be more persuasive as compared to human-like VIs.

VIs can project themselves as “robots.” This suggests two things: (1) VIs become “less human” regardless of design cues, and (2) visual human-like design cues become inconsistent with the “robot” description. At the same time, this new information may align with the design cues of VIs that appear to be less human-like and lead to favorable responses to less human-like versus human-like VIs. Extant literature provides unfavorable social responses, including credibility and persuasion, for the misalignment of social information. This has been noted in the difficulty to categorize highly realistic artificial characters as humans or artificial agents (MacDorman & Ishiguro, 2006) or humans or nonhumans (Cheetham, Suter, & Jancke, 2014) based on design cues. But most researchers have focused on design features for “perceptual mismatch.” For example, human versus artificial features on faces of digital characters (Seyama & Nagayama, 2007) and typical versus atypical faces (Langlois & Roggman, 1990). Considering that knowledge cues can dictate impressions of “humanness” (Chaminade & Cheng, 2009), we posit that a “robot” description can possibly cause a perceptual mismatch with human-like design and lead to less persuasion from human-like VIs as compared to less human-like VIs.

H2: In the presence of knowledge cues, people will perceive less human-like VIs to be more persuasive as compared to human-like VIs.

People with a high need for cognition look for more information before making their decisions (Epley, Waytz, & Cacioppo, 2007). When provided with no information they resort to relying on less human-like VIs. This is because their tendency to not rely on human beings is transferred to the realm of VIs, making human-like VIs as less trustworthy as real human beings. However, in the presence of information about the VI,

people with a high need for cognition tend to rely on knowledge cues. These knowledge cues project the VIs, both less human-like and human-like, as “robots”. Processing these knowledge cues activates machine-like cognitive representations in the minds of people with a high need for cognition. Such cognitive representations clash with the human-like cognitive representations activated by human-like design, leading to a perceptual mismatch (Kätsyri, Förger, Mäkääinen, & Takala, 2015). In such an event, the less human-like VI can achieve a better perceptual match with knowledge cues, owing to the less human-like design as compared to the one which has a more realistic design. People with a high need for cognition will then prefer to interact with the less human-like VI owing to a perceptual match.

H3a: In the presence of knowledge cues, people with a high need for cognition (versus low) will perceive less human-like VIs to be more persuasive as compared to human-like VIs.

Lonely people anthropomorphize human-like and less human-like VIs equally. Since they seek human-like connections in digital worlds, we have reason to believe that they will prefer to interact with human-like VIs as compared to less realistic VIs. Lonely people rely on immediately available cues in the environment and use them to make judgments about credibility (Epley, Waytz, & Cacioppo, 2007). Knowledge cues to them are secondary to design cues because they can require a greater amount of cognitive load (Cacioppo, Petty, & Feng Kao, 1984; Sweller, 2010). Hence, when provided with knowledge cues, we propose that lonely people will continue to rely on design cues because (1) they want to build relationships with humans, and so with human-like VIs owing to the design similarity to human beings, and (2) knowledge cues require extra amount of information processing and cognitive load.

H3b: In the presence of knowledge cues, lonely people (versus not) will perceive human-like VIs to be more persuasive as compared to less human-like VIs.

Finally, while lonely people may prefer to interact with and trust human-like VIs, some people with a high need for cognition may be more skeptical than others. In the presence of additional information, lonely people with a high need for cognition may seek a perceptual match before making judgments about the VIs. Since less human-like VIs will better match the “robot” description, we propose that lonely people with a high need for cognition will prefer to build relationships with less human-like VIs as compared to those that are human-like.

H3c: In the presence of knowledge cues, lonely people with a high need for cognition will perceive less human-like VIs to be more persuasive than human-like VIs.

6. Method

We conduct two experiments to test whether disposition and knowledge cues influence the credibility perception of human-like versus less human-like VIs. In both experiments, participants were recruited from Amazon Mechanical Turk for “rating a set of pictures” and data was collected through Qualtrics. All participants were US residents, social media users, above 18 years of age, and fluent in English. Participants were rewarded \$0.50 for completing the study. Conducting our experiment online using pictures of actual VIs enabled us to replicate real-world conditions as closely as possible. VIs flourish in the online space, especially on social media, a popular and lucrative platform for opinion leaders (Mangold & Faulds, 2009). Considering that VIs are most prevalent on Instagram, we reproduced the layout of 3 pictures to replicate what users would often come across on their Instagram feed. It is from looking at these pictures that users make their first impressions.

The study focuses on measuring credibility perceptions of VIs based on the Ohanian’s source credibility model (Ohanian, 1990). Ohanian provides a multidimensional framework to measure perceived credibility: attractiveness, trustworthiness, and expertise. We create an index from these constructs for a measure of perceived credibility. Need for cognition is measured with a 6-item Likert scale (Cacioppo, Petty, & Feng Kao, 1984) and loneliness is measured using Russell’s (1996) 20-item scale. Finally, humanness is measured using the 5-item scale provided by Ho and MacDorman (2010). All scales were valid and reliable¹ and tested for item correlation and deletion.

To determine different levels of humanness among VIs, a pretest² was conducted. 145 participants ranked the pictures of 31 VIs for humanness on a 5-item scale provided by Ho and MacDorman (2010) ($\alpha = 0.92$). A repeated-measures ANOVA with a Greenhouse-Geisser correction determined that mean humanness differed statistically significantly between the influencers ($F(10.857, 1563.432) = 89.677, P < 0.000$). A post hoc analysis for pairwise comparisons with a Bonferroni adjustment enabled us to randomly select 3 influencers, representing different levels of increasing humanness. The three levels were named “Not Human”, “Less Human,” “Human,” for increasing humanness (Cheetham, Suter, & Jäncke, 2011). In addition, we randomly selected a robot-like VI to represent the least amount of humanness. We did this to provide a frame of

reference for increasing humanness. The selected VIs can be found in Figure 2.



Figure 2. VIs for Experiment 1 (increasing humanness left to right)

6.1. Experiment 1: The Moderating Role of Disposition

In Experiment 1, we assess whether people with a high need for cognition will consider human-like VIs less persuasive as compared to less human-like VIs (H1a). We also test whether lonely people will perceive human-like VIs to be more credible as compared to less human-like VIs (H1b). Finally, we test the impact of loneliness and cognition on the effect of humanness on the credibility of VIs (H1c).

471 participants made valid observations and rated pictures³ of a VI. 4 VIs varying in humanness were selected for the study (Figure 2). No knowledge was provided about the VI. A manipulation check asking participants to choose a category for the VIs (Not human, Less Human, and Human) confirmed the expected manipulation. The experiment employed a three-factor (need for cognition, loneliness, humanness) between-subjects design, with humanness, need for cognition, and loneliness measured as continuous variables. The humanness of the VI was manipulated (human (human-like), less human (less human), not human (least human), and robot (machine-like) with the help of VI pictures. Participants were asked to imagine looking at the pictures on their social media accounts and rate them for perceptions of humanness, attractiveness, trustworthiness, and expertise. We averaged the ratings of attractiveness, trustworthiness, and expertise to form a credibility index ($\alpha = 0.851$) that represented the persuasive effectiveness of the VI (Ohanian, 1990). We ran a regression of this index on (1) humanness, (2) need for cognition, (3) loneliness, (4) interaction of humanness and need for cognition, (5) interaction of humanness and loneliness, (6) interaction of humanness, need for cognition, and loneliness. We conducted the analysis on PROCESS macro used for moderation and mediation analysis on SPSS (Hayes, 2012).

¹ A reliability analysis for scales can be made available on request.

² A detailed pretest analysis can be made available on request.

³ Three most recent headshots displaying a range of expressions were selected from the VI’s Instagram feed. The pictures were presented together just like an Instagram feed.

We found a main effect of humanness ($\beta = 0.173$, $p < 0.000$), and a main effect of need for cognition ($\beta = -0.175$, $p = 0.029$). Participants' evaluations of persuasion were more positive for human-like VIs, and participants who subjected themselves to a considerable amount of thought and cognition are more liable to find VIs less persuasive. As hypothesized, we found a two-way interaction of humanness and need for cognition on persuasion ($\beta = -0.135$, $p = 0.037$). Though small, the negative effect of need for cognition suggests that people who think more are less likely to be influenced by more human-like VI. This supports H1a.

We found a significant main effect of loneliness ($\beta = 0.101$, $p = 0.013$), while the main effect of humanness remained significant ($\beta = 0.143$, $p < 0.000$). The interaction between humanness and loneliness was also significant ($\beta = -0.060$, $p = 0.003$). Surprisingly, though with a small effect, this moderation is negative suggesting that lonely people tend to find less human-like VIs to be more credible. We thus reject H1b.

Finally, we examined the three-way interaction of humanness, need for cognition, and loneliness. The main effects of humanness ($\beta = 0.138$, $p = 0.001$), cognition ($\beta = -0.160$, $p = 0.046$), and loneliness ($\beta = 0.095$, $p = 0.020$) on credibility are significant. The three-way interaction was also significant ($\beta = -0.141$, $p = 0.001$). This result suggests that people who are lonely and have a high need for cognition perceive less human-like VIs to be more credible as compared to those that are more human-like. This supports H1c.

In the first experiment we find that people who think more, are more likely to be persuaded by less humanlike (versus human-like) VIs, whereas those who think less are more likely to be persuaded by humanlike VIs. We argue that these effects occur because people with higher levels of cognition look for additional information before trusting people or heeding their advice. They are less likely to make judgments based on readily acceptable design cues, and so without any additional information will lean towards trusting less human-like VIs more. We also find that people who are more lonely are more likely to be persuaded by less human-like VIs. We believe this may be because experiences with other humans that have led to loneliness in the past, have motivated them to avoid such prospective experiences in the future. Finally, as expected, we found that lonely people with a high need for cognition will make judgements more consciously and prefer to interact with less human VIs as compared to human-like VIs. This is a result of their skeptical nature, and yet their need to connect.

⁴ Definition: Digital avatars that are highly similar to human beings in appearance and behavior but are not real people. They are

6.2. Experiment 2: The Moderating Role of Knowledge Cues

Experiment 2 examines the moderating role of knowledge cues (H2). Extant research has provided evidence for the favorable reactions to the alignment of social cues. Considering “robot” description as a social knowledge cue, we suggest that alignment with less humans will lead to positive social responses.

For this experiment, we chose 2 VIs from Instagram (Figure 3): Bermuda, representing the human-like digital agent, who was also rated as the most human-like in the pretest, and Mono Mars, who represented the robot-like agent. While Bermuda projects herself as “robotic,” she looks very human-like. Mono Mars also projects itself as a “robot” but also looks like a robot. Hence, this comparison provides a fair basis to explain and test perceptual match or mismatch. Bermuda and Mono Mars were significantly different for humanness ratings ($F(1, 412) = 28.85$, $p < 0.000$). Participants in the “without description” condition were just shown a set of pictures to rate for the dependent variables. In the “with description” condition, participants were given: the name of the VI shown in the pictures; a description (robot); and a “more information” section that described the VI as a virtual human created by a company in California. Participants were then provided with a definition⁴ of virtual humans. 414 participants made valid observations.

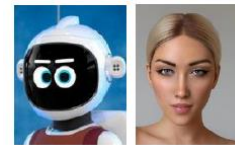


Figure 3. VIs for Experiment 2 (increasing humanness left to right)

The experiment employed a four-factor (need for cognition, loneliness, humanness, knowledge) between-subjects design, with humanness, need for cognition, and loneliness measured as continuous variables. Humanness (human-like versus robot-like) and knowledge (with description versus without description) were manipulated. PROCESS for SPSS was used for analysis (Hayes, 2012). We ran a regression of the persuasion index on the independent variables for the main effects of humanness and knowledge. The main effect of humanness ($\beta = 0.136$, $p < 0.000$), and knowledge was significant ($\beta = 0.297$, $p < 0.019$). We then ran a regression of persuasion on the interaction between humanness and knowledge, which

programmed by computer developers and can be found on most digital platforms like social networks.

was significant ($\beta = -0.274$, $p < 0.010$). This supported H2, suggesting that when knowledge (robot description) is provided, the effect of humanness (design) on credibility perceptions decreases—people tend to find a “not-human” VI to be more persuasive as compared to the “human” one.

We also examined the effects of need for cognition and loneliness on credibility perceptions when additional information is provided by running an interaction among (1) humanness, knowledge, need for cognition, (2) humanness, knowledge, loneliness, and (3) humanness, knowledge, need for cognition, loneliness. The main effects of humanness ($\beta = 0.119$, $p = 0.001$), knowledge ($\beta = 0.270$, $p = 0.033$), and need for cognition ($\beta = -0.197$, $p = 0.022$) are significant. The interaction between humanness, knowledge and need for cognition was found to be nonsignificant, rejecting H3a. The main effects of humanness ($\beta = 0.089$, $p = 0.030$), knowledge ($\beta = 0.281$, $p = 0.023$), and loneliness ($\beta = 0.096$, $p = 0.033$) are significant. The interaction between humanness, knowledge, and loneliness is nonsignificant. We thus reject H3b. The results suggests that the disposition does not affect the impact of human-like design when information is provided: people will continue to prefer less human-like (not human) over human-like VIs if they are projected as “robots” in their descriptions. These further strengthen the case for visual and knowledge alignment to cover for the effects for user disposition. Finally, we examined the interaction between humanness, knowledge, need for cognition, and loneliness. The effect was nonsignificant, thus not supporting H3c and reinforcing prior findings that in the presence of additional information about the VI, disposition does not impact the effect of humanness on credibility perceptions.

Results from the second experiment suggest that in the presence of knowledge cues people tend to find the robot-like VI more credible as compared to the human-like VI. This result supports our proposition about knowledge cues (robot-like description) creating a perceptual match between design and knowledge cues. People thus chose to perceive robot-like VIs as more credible and are more likely to be persuaded by them. We also found a nonsignificant effect of disposition in the presence of knowledge cues. This result highlights the importance of providing information as well as the alignment of that information with design to override dispositional preferences.

7. Discussion

Our results provide three counterintuitive findings. We proposed and found that people with a high need for cognition do not prefer to interact with human-like

digital characters. In a world where digital security and privacy are becoming increasingly important and widely known, people are more likely to think more about their activities online. Hence, the consideration of the preference for less human-like design is important and timely. Contrary to what we proposed, we found that lonely people prefer to interact with less human digital agents in the context of persuasion. It is possible that people avoid replicating bad experiences in the real world in the digital environment, which they use as an escape from the real world. Lastly, we found that providing important and honest information, which is believable and acceptable (perceptual mismatch) can help overcome the negative impact of disposition on the effect of human-like design on credibility perceptions. This indicates that the alignment of knowledge and design cues is essential for favorable social perceptions towards technology.

7.1. Implications

With technology becoming more and more human, it is imperative to understand user preferences. We have just scratched the surface. Further research can explore various elements of design like face versus body, no movement versus movement, as well as gestures. While these are morphological characteristics, functional or behavioral elements of digital agents can also lead to variations in response (Duffy, 2003). Furthermore, the study can be conducted in other digital environments in contexts other than persuasion, like teamwork and social structuring, to generalize results more robustly. Lastly, our experiments use human-like VIs and one robot-like VI. There are however animal-like and object-like VIs on Instagram that are also quite popular. Exploring their comparison to human-like and robot-like influencers would significantly add to the body of knowledge exploring anthropomorphism.

Our findings also raise a practical concern that companies hoping to increase the persuasiveness of their communications using digital agents should pay close attention to knowledge cues and other factors that may influence the perceptual match sought by users. More importantly, our findings have implications for digital agents used in health and counseling. When designing agents to serve the needs of patients with depression or those in prison or war-ridden territories, designers need to be aware of the preference for less human-like or robot-like agents. Furthermore, these insights could also be useful in a pandemic where many people must spend time in isolation. Indeed, people who use smart devices have been found to be more lonely and more preoccupied (Wang, 2017). Perhaps they are more acquainted with their digital environment and thus prefer to interact with just machine-like beings.

7.2. Limitations

Although we tried to control for factors that may influence our results, and Amazon Mechanical Turk is a trusted source for data collection (Keith, Tay, & Harms, 2017; Mason & Suri, 2012), we suggest that a lab experiment may help to validate the results of our experiment. The use of other kinds of digital characters prevalent on social media for different purposes like socializing, gaming, and storytelling can increase generalizability.

We use perceptions of VIs to draw our conclusions. While this may be a good starting point, the use of a dependent variable that reflects behavioral responses from persuasion can strengthen our findings. Furthermore, we believe while perceptions of the digital agents are important, the persuasiveness of the message, the advertised cause or product, branding, and the platform itself can also influence user perceptions. While we tried to control for brands and social networks, incorporating products in the experimental design can be important to determine actual behavior.

8. Conclusion

The paper identifies levels of human-likeness that are more acceptable to the users with varying need for cognition and loneliness in the context of persuasion. Results from our study reveal that in the absence of knowledge, people with a high need for cognition and those that are lonely perceive less human-like digital agents to be persuasive. However, in the presence of additional knowledge, people tend to find agents that match the description provided in additional knowledge to be more persuasive. This result holds regardless of the level of need for cognition or loneliness. Our research highlights user preferences for design of digital agents in the absence of knowledge and the importance of perceptual match in the presence of additional information. As such it informs companies to consider the skepticism and loneliness of their audience, as well as relevance and transparency of information, before designing agents for persuasive communication.

9. References

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