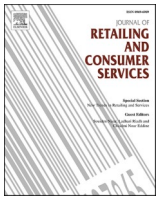
Journal of Retailing and Consumer Services 75 (2023) 103459



Contents lists available at ScienceDirect

Journal of Retailing and Consumer Services

journal homepage: www.elsevier.com/locate/jretconser





# Stereotyping human-like virtual influencers in retailing: Does warmth prevail over competence?

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ARTICLE INFO

Handling Editor: H. Timmermans

*Keywords:*
Virtual influencer
Anthropomorphism
Stereotype content model
Warmth
Competence

ABSTRACT

Building upon the Stereotype Content Model (SCM), the current research provides insights into how virtual influencers (VIs) influence consumer responses. More specifically, it investigates the associations between the VI's anthropomorphism and stereotypical judgments of the VI's warmth and competence as well as the differential and mediating roles of these stereotypes in influencing consumers' willingness to follow the VI's recommendations and purchase intentions. The results support the idea that anthropomorphizing VIs has a direct bearing on stereotyping VIs along the competence and warmth dimensions of the SCM. Consistent with the "Primacy-of-Warmth Effect" hypothesis, the study's findings show that perceived warmth, compared to perceived competence, is positively more associated with consumers' willingness to follow the VI's recommendations. Furthermore, the findings reveal that perceived warmth mediates the association between the VI's anthropomorphism and consumers' willingness to follow the VI's recommendations. However, the findings lend partial support to the mediating role of competence. The willingness to follow the VI's recommendations, in turn, is positively associated with purchase intention. The paper wraps up with some implications for research and practice.

## 1. Introduction

Virtual influencers (VIs) are exponentially growing in popularity worldwide. This rising trend has enticed retailers such as Marks & Spencer, Amazon, Pascun, and Alibaba to explore the digital realm by appointing VIs to lead advertising campaigns, sell products, or even become an extension of their retail brands (Douglass, 2022; Rasmussen, 2022; Allsup, 2023). In the past few years, social media had hosted more than 200 VIs, most of them are active on Instagram (Hiort, 2022). More striking, recent reports reveal that VIs enjoy an engagement ratio three times higher than human influencers on social media, and some experts speculate that this figure is likely to increase as social media moves into the metaverse and VIs become more commonplace (Baklanov, 2021; Kervyn et al., 2012). Interestingly, almost half of social media users who follow human influencers have equally manifested interest in VIs (Mcgrath, 2022). According to a 2022 survey conducted in the US and mandated by *Influencer Marketing Factory* (a service influencer marketing agency), 58% of surveyed people reported following at least one VI and 35% acknowledge purchasing a product recommended by a VI. In a similar vein, a recent survey conducted in the UK indicated that 54% of consumers find virtual entities appealing to some extent, just like human influencers (Influencer Marketing Factory, 2022). Obviously, the rise of VIs is unlocking new opportunities for brands and retailers. With retailers' migration to the metaverse (Murad and Smale, 2022), brands such as Nike, Puma, Chanel, and Louis Vuitton have started partnering with VIs (AJ Marketing, 2023).

Despite the novelty and growing popularity of VIs, recent sources point out some discrepancies in the perceptions and impressions that people have toward VIs. For instance, anecdotal evidence suggests that people do not judge VIs in the same way; while some believe VIs to be a force for good fighting loneliness and isolation (Kuch, 2022), others describe VIs as creepy and eerie agents (Araque and Moynihan, 2021). In this vein, Lou et al. (2022) report that consumers' appraisals of VIs come with mixed judgments ranging from fear to fascination and uncanniness to intrigue. As a case in point, in the UK, the retailer Marks & Spencer's decision to use a VI (named Mira) in order to promote clothing was met

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https://doi.org/10.1016/j.jretconser.2023.103459
Received 8 April 2023; Received in revised form 11 June 2023; Accepted 13 June 2023
Available online 25 June 2023
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with mixed reactions from consumers. In fact, while some consumers expressed their admiration for the VI, Mira, on Instagram (@marksandspencer_mira), through posts like "so cool" (paulaferriggi), "I can't wait to see more of Mira" (ljyuen), and "Love it" (marksandspencerireland_lisa), others have expressed their disappointment and disgust through posts such as "Creepy. I don't get it" (olivia_corden), "Please tell me this is a nightmare and I'm going to wake up soon! Why do we need to invent fake unattainable people?" (whatthismamadid), and "Awful!! Why not use real people?!" (michelle_wi11). These conflicting perceptions and impressions concerning VIs suggest that, similar to human beings, VIs can be stereotyped as well.

Stereotypes associated with social media influencers represent consumers' lay beliefs about influencers as social agents (Kim and Read, 2021; Roccapriore and Pollock, 2022; Fernandes et al., 2022) in that influencers are judged by consumers based on their capability of manifesting prosocial intentions (i.e., warmth) and their ability to execute their intentions (i.e., competence). Importantly, these stereotypical judgments have a direct bearing on people's behaviors. In fact, research in social psychology and marketing shows that stereotype activation influences perceptions, emotions, and behaviors (e.g., Kunda and Spencer, 2003; Söderlund, 2022).

Previous research in marketing has examined stereotypes associated with brands (Kolbl et al., 2020; Liu et al., 2022), organizations (Aaker et al., 2010; Yang and Aggarwal, 2014), advertising (Zawisza and Cinnirella, 2010; Lee and Oh, 2021), Chatbots (Roy and Naidoo, 2021; Li and Wang, 2023), and avatars (Li et al., 2023). Also, in the realm of influencer marketing, few studies have investigated stereotypes associated with social media influencers (Kim and Read, 2021; Kim and Read, 2022; Crisafulli and Singh, 2022). Yet, to the best of our knowledge, no study has yet investigated VIs from the SCM perspective. The current research endeavors to fill this gap.

Investigating stereotypes in the context of VIs is important for many reasons. For instance, unlike human influencers who by default convey an authentic human-like appearance, anthropomorphized VIs (i.e., virtual characters with human characteristics) could create the impression they are fake and staged, and thus affect the extent to which consumers trust them and respond to them (Lou et al., 2022). Moreover, given that humans, in general, tend to have an aversion or hostility against non-human entities such as robots and machines (Wirtz et al., 2018; Chen et al., 2021), examining stereotypes associated with anthropomorphized VIs, in particular, will extend our understanding of how consumers would perceive and respond to human-like influencers. Furthermore, as research on influencer marketing has focused predominantly on human influencers' stereotypes (Kim and Read, 2021, 2022), it becomes critically important to explore whether the applicability of recent research findings on stereotypes associated with human influencers still holds in VIs settings. This might help inform consumer relationships with virtual influencers above and beyond those established with human influencers with particular attention to the process underlying the perception of VIs, in terms of anthropomorphism, warmth, and competence dimensions.

Previous studies point to the persuasiveness of digital influencers on consumers' purchasing decisions; almost 50% of internet users follow influencers on social media and trust influencers' recommendations (Digital Marketing Institute; Young, 2017), while 40% have purchased a product after viewing it on YouTube or Instagram. In 2018, almost 19% of U.S. consumers purchased a product following an influencer's recommendation (Vrontis et al., 2021; Audrezet and Charry, 2019). While VIs are constantly solicited to endorse products to their followers, there is a dearth of studies investigating their marketing effectiveness (Franke et al., 2023; Lou et al., 2022). The current research aims to add insights into this research line.

Against this backdrop and drawing on the Stereotype Content Model (SCM; Fiske et al., 2002), our research aims to understand how consumers perceive and judge VIs, and how the resulting impressions about VIs, in turn, influence their behavioral intentions. We theorize that the stereotypes of warmth and competence are likely to be ascribed to human-like VIs. Particularly, both dimensions of stereotypes are likely to be associated with consumers' predispositions to follow VIs' recommendations and purchase intentions, to a different extent.

The remainder of this paper is organized as follows. First, drawing on the SCM, we develop a conceptual model along with a set of hypotheses, followed by the study's methodology. We then report the study's findings. The paper concludes with theoretical and managerial implications, limitations of the study, and some directions for future research avenues.

## 2. Theoretical background: The Stereotype Content Model

Stereotypes have been discussed in the domain of social psychology as a proxy of social judgment (Cuddy et al., 2008). According to Keyser and Kunz (2022), when interacting with an individual for the first time, people assess if this individual has good and cooperative intentions which translate into warmth (i.e., being honest, friendly, and sincere), or if that individual could act upon her/his intentions which refer to her/his competence (i.e., being knowledgeable, creative, and efficient). Such cognitive schemas refer to as stereotypes (Guan, 2009). Particularly, people are likely to use stereotypes to make a judgment about another individual when they have a deficit of individuating information (Jussim, 2012). As such, people use stereotypes as a cognitive shortcut (Cervellon et al., 2019; Chu et al., 2016). The SCM asserts that warmth and competence represent the fundamental dimensions that capture almost entirely the ways by which people judge others (Fiske et al., 2007). Warmth refers to the way people perceive the intentions of others such as if an individual is seen as well-intended, then the individual is trustworthy (Fiske, 2012). Competence refers to the ability of an individual to act based on her/his intentions (Cuddy et al., 2011) in that if the individual is perceived as having the ability to execute a certain role, then s/he is recognized to be competent (Fiske, 2012).

While warmth and competence have been recently discussed in the literature to examine human-robot interactions (Yoganathan et al., 2021) and chatbots (Roy and Naidoo, 2021), we surmise that both dimensions of the SCM could be also readily applied to a VIs context. Recent work lends support to this assertion. For instance, Li et al. (2023) have found that digital human avatars would convey warmth and competence as well. In another vein, research in social psychology shows that stereotype activation would influence perceptions as well as behaviors (e.g., Kunda and Spencer, 2003). Taken together, we argue that the SCM may offer a more nuanced perspective on understanding consumers' responses to human-like VIs.

## 3. Conceptual development and hypotheses

Based on the SCM foundations discussed above, we theorize that anthropomorphizing VIs is likely to be associated with consumers' judgments of the VIs' warmth and competence, which would subsequently, influence consumers' behaviors in terms of predisposition to follow VIs' recommendations and purchase intentions. Fig. 1 depicts a conceptual model guiding the current research.

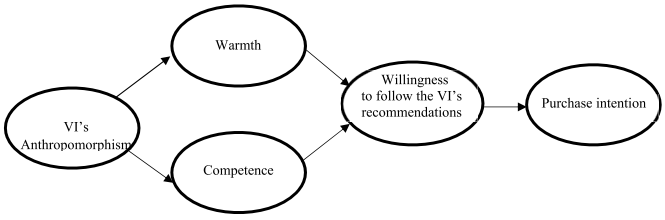



**Fig. 1.** VI Stereotype model.

### 3.1. The role of anthropomorphism in stereotypical judgments of VIs

The term "anthropomorphism" alludes to ascribing humanoid traits to non-human entities (Guthrie, 1993). People easily anthropomorphize an entity when this incorporates manifest human traits (e.g., smile; Epley et al., 2007). Previous research shows that some anthropomorphic cues could be effective in conveying humanness to objects and social agents. For instance, the human shape, animacy, and perceived interactivity all elicit anthropomorphizing objects (Connell, 2013; Burgoon et al., 2000; Morewedge et al., 2007).

Arsenyan and Mirowska (2021) argue that VIs convey different levels of anthropomorphism. Some VIs have a lifelike appearance and a realistic look (i.e., human-like VIs such as Shudu and Lil Miquela), while others look like a cartoon and are physically disproportionate with exaggerated mouths and eyes (i.e., cartoon-like VIs such as Bodybyralph and Noonoouri). These are depicted as creatures rather than humans (i.e., animal-like VI such as Bee). As such, human-like VIs appear to be particularly more prone to anthropomorphism.

Meanwhile, anthropomorphizing virtual agents such as VIs would convey warmth and competence (Niewiadomski et al., 2010), which in turn, help address two fundamental human needs (Epley et al., 2008). First, the need for social connection, which relates to warmth and is conveyed through friendliness, helpfulness, trustworthiness, and people's willingness to establish and maintain social ties (Fiske et al., 2007). Second, the need for mastering one's environment, which would appeal to competence conveyed through intelligence, self-confidence, efficiency, and people's motivation to achieve their intentions and goals (Wojciszke and Abele, 2008).

The claim that competence and warmth are both relevant for judging social agents like VIs, finds support in the "computers are social actors" (CASA) paradigm suggesting that people mindlessly employ the same social heuristics for human-computer interactions (Nass et al., 1994). In the context of VIs, Salvador (2022) show that human-like VIs are perceived through more favorable lenses as compared to cartoonlike ones, and that human characteristics can be ascribed to them, suggesting a potential effect of anthropomorphizing VIs on how they are judged and perceived. Taken together, we argue that VI's anthropomorphism is likely to be associated with the follower's judgment of VI's warmth and competence. From this, H1 and H2 flow.

**H1**. VI's anthropomorphism is positively associated with the VI's perceived warmth.

**H2**. VI's anthropomorphism is positively associated with the VI's perceived competence.

### 3.2. The associations between VIs' stereotypical judgments and willingness to follow VIs' recommendations

Although warmth and competence have been largely recognized as two fundamental dimensions underlying social judgment, there is widespread agreement on warmth being more important than competence in shaping judgments and perceptions. This is referred to as the "Primacy-of-Warmth Effect" (Abele and Wojciszke, 2007). The "Primacy-of-Warmth Effect" posits that warmth plays a primary role in shaping impressions as warmth cues are believed to have a stronger influence on impressions compared to competence cues (Wojciszke et al., 1998). This view is consistent with many evolutionary psychologists' positions (e.g., Zhang and Wang, 2018) advocating that the "primacy-of-warmth" holds realistic because when facing situations of survival or uncertainty, judging others' intentions, which is akin to warmth, would urgently prevail over judging their ability to act on their intentions (e.g., competence).

The inclination to give warmth higher importance over competence when forming impressions about others is well-documented in the literature. For instance, Abele and Wojciszke (2007) found that when individuals are asked to rate the relative importance of warmth and competence traits, warmth traits rank higher than competence ones. Along the same line, Ybarra et al. (2001) found that people recognize warmth traits promptly compared to competence traits.

Building on the "Primacy-of-Warmth Effect," this study extends the notion of warmth being more prevalent than competence in impressions' formation in a VIs context. In the same vein, we propose that the primacy effect of warmth is likely to prevail in influencing behavioral intentions as well. That is, in the context of VIs, warmth is likely to be positively more associated with consumers' willingness to follow the VI's recommendations, compared to competence. From this H3 flows.

**H3**. The VI's warmth is more strongly associated with willingness to follow the VI's recommendation than the VI's competence.

### 3.3. The mediating role of stereotypical judgments of VIs

The mediating effects of warmth and competence have been barely discussed in the marketing literature. For instance, the work by Zhang et al. (2020) on branding suggests that warmth, but not competence, mediates the relationship between brand anthropomorphism and attitude toward the brand. However, in the context of humanoid robots, Van Doorn et al. (2017) show evidence of both competence and warmth playing a mediating role in the link between the robot's human-likeness and service outcomes such as satisfaction and behavioral intentions. Applied to the context of social media influencers, Kim and Read (2021) found that warmth and competence are concurrent mediators of the effect of the influencer's appearance (i.e., smiling face) on Instagram followers' responses. Indeed, warmth and competence judgments lead to the admiration of influencers, thereby inducing positive behavioral responses (e.g., liking and sharing posts). Hence, it is safe to argue that warmth and competence would mediate the association between the VI's anthropomorphism and consumers' willingness to follow the VI's recommendations, referred here to as the extent to which a follower would take into account the suggestions or advices made by the influencer (Casaló et al., 2020). From this H4 and H5 are proposed.

**H4**. The VI's warmth mediates the association between the VI's anthropomorphism and consumers' willingness to follow the VI's recommendations.

**H5**. The VI's competence mediates the association between the VI's anthropomorphism and consumers' willingness to follow the VI's recommendations.

### 3.4. The association between consumers' willingness to follow the VI's recommendations and purchase intentions

The effectiveness of influencers on social media relies on their ability to boost consumers' purchase intentions, which reflects the follower's likelihood to buy the recommended product or service in the future (Lee and Eastin, 2021). The link between social media influencers' recommendations and purchase intention is well-documented in the literature. For instance, Sokolova and Kefi (2020) found that consumers are likely to purchase beauty and fashion products following the influencer's recommendations on YouTube and Instagram. Likewise, Hsu et al. (2013) show that recommendations made by influencers such as bloggers have a significant effect on consumers' intention to shop online, particularly when these recommendations are deemed useful.

In regards to the VIs setting, Thomas and Fowler (2021) pointed out that Artificial Intelligence (AI) influencers could be as persuasive as human influencers (i.e., celebrities) in favorably influencing consumers' attitudes and purchase intention. Likewise, a recent survey conducted in the US provides some evidence of the positive relationship between consumers' willingness to follow VIs' recommendations and purchase intentions; nearly 35% of surveyed people reported purchasing a product recommended by VIs (Influencer Marketing Factory, 2022). In this light, one could argue that consumers' predisposition to follow the VI's

recommendations would translate into a proneness to buy the recommended products. From this H6 flows.

**H6**. Willingness to follow the VI's recommendations is positively associated with consumers' purchase intentions.

## 4. Methodology

### 4.1. VIs selection

Since the objective of this study is to examine consumers' judgments of human-like VIs and consumers' intentional responses to VIs, two well-established VIs, namely Lil Miquela and Shudu Gram were deemed instrumental to increase the study's ecological or external validity as well as the findings' generalizability. Two main criteria guided the selection of the VIs: (1) they must be well known to respondents; (2) they should have a verified and accessible Instagram account. Both Lil Miquela and Shudu Gram have been frequently cited in many research studies (Moustakas et al., 2020) and press articles (Kuch, 2022; Ahmed, 2022) as gaining massive traction across Instagram, and are often solicited by global brands and advertisers (da Silva Oliveira and Chimenti, 2021; Silva and Bonetti, 2021). According to influencer marketing agencies, both VIs rank among the top 10 Influencers (Dubey, 2020; Ansari, 2022) and hold a verified Instagram account (Travers, 2022).

### 4.2. Participants

The empirical study was carried out in the UK. Respondents were recruited through a marketing firm. To qualify for the study, participants should meet the two following screening criteria: (1) they should be familiar with VIs, and (2) have an Instagram account and access VIs posts. Three hundred and nighty-eight qualified persons were initially contacted to take part in the study. Five participants did not complete the survey and were therefore excluded from the pool of participants. Finally, we ended up with 393 reliable respondents: 194 participants for Shudu Gram and 199 for Lil Miquela. The sample characteristics appear in Table 1. We used stratified sampling (probability sampling) to maximize the likelihood that the study's sample is representative of the VIs audience. According to VIs' experts (Baklanov, 2021), 61.45% of the VIs audience are women, and 37.83% of the VIs audience is in the bracket age between 18 and 24 years old, and 25.39% are between 25 and 34 years old. Table 1 shows that overall the sample characteristics are close to the audience of VIs (61.1% of respondents are women, and 38.9% are between 18 and 24; however, the percentage of 25–34 is higher and is at 42.7%). In each stratum, participants are randomly assigned to one of the selected VIs.

### 4.3. Data collection instrument

A standardized online questionnaire was used to collect data. After reading a description of the VI profile, participants were provided with a link to the VI's Instagram account and asked to spend some time browsing through its content (i.e., reading posts, and viewing photos and videos). Thereafter, participants were redirected to fill out a survey that include questions about the VI's appearance (i.e., anthropomorphism), their stereotypical judgments of the VI (i.e., warmth and competence), their willingness to follow the VI's recommendations and their purchase intentions, in addition to some questions related to their demographic characteristics (age and gender).

**Table 1**
Sample characteristics.

| | Shudu Gram (n=194) | Lil Miquela (n=199) | VIs Total (n=393) |
|---|---|---|---|
| Gender | | | |
| Male | 38.7% | 39.2% | 38.9% |
| Female | 61.3% | 60.8% | 61.1% |
| Age | | | |
| 18-24 | 36.1% | 41.7% | 38.9% |
| 25-34 | 44.8% | 40.7% | 42.7% |
| 35-44 | 13.9% | 14.1% | 14.0% |
| 45 or older | 5.2% | 3.5% | 4.3% |

### 4.4. Measurements

Anthropomorphism (Cronbach's alpha = .906) was measured based on four items[1] adapted from Bartneck et al. (2009) on a seven-point semantic differential scale. The used items were as the following: (1) "[VI] is fake[2]/natural," (2) "[VI] is non human-like/human-like," (3) "[VI] is unconscious/conscious," and (4) "[VI] is artificial/lifelike." Perceptions of warmth (Cronbach's alpha = .941) and competence (Cronbach's alpha= 0.937) of the VI were measured using five-item scales each (Kervyn et al., 2012; Lee et al., 2017). Examples of scale items measuring warmth include "I believe that [VI] is kind" and "I believe that [VI] is generous." Typical items capturing the competence dimension include "I believe that [VI] is effective" and "I believe that [VI] is skilled." Willingness to follow the VI's recommendations (Cronbach's alpha = .922) was captured with a 2-item scale (Mohanty, 2021). These items are "The likelihood that I would follow [VI] recommendations is high" and "The probability that I would follow [VI] recommendations is high." Purchase intention (Cronbach's alpha = 0.930) was assessed with three items (Tran et al., 2019; Sokolova and Kefi, 2020). Examples of scale items include "I would purchase products/brands promoted by [VI] in the future" and "I would actively seek out products/brands shown by [VI] to purchase them." All measures, except anthropomorphism, were made on Likert scales anchored by "1/strongly disagree" and "7/strongly agree." All items are listed in Table 2 along with their psychometric properties.

### 4.5. Common method bias

When designing the study's questionnaire, we included different scale formats and placed questions that relate to the dependent variables prior to those of predictors to control for potential common method bias (e.g., Podsakoff et al., 2003; Murray et al., 2005). Moreover, we

[1] It is worth mentioning that we have decided to not include the item "moving rigidly/moving elegantly" from the Bartneck et al.'s five-item measurement of anthropomorphism and have slightly modified the item "machinelike/humanlike" by replacing it by "non-humanlike/humanlike." The Bartneck et *al.*'s measurement was originally used in the context of human-robot interactions. VIs, as digital entities or personas, are different from physical robots. We believe that the item "moving rigidly/moving elegantly," which relates to the movements or velocity of a robot, is irrelevant in a VIs setting. Additionally, considering that individuals tend to perceive human-like VIs more human rather than perceiving them strictly as machines or robots, we thought it would be more appropriate to measure the extent to which participants humanize the VI using a semantic differential scale anchored with "non-humanlike/humanlike" (instead of "machinelike/humanlike" as in the Bartneck et al.'s measurement).

[2] An anonymous reviewer of this paper has raised an important point regarding the potential influence of other artificial characteristics, such as makeup use or plastic surgery, on participants' perception of anthropomorphism in the VIs. The inclusion of the "fake/natural" anchor in the anthropomorphism scale may indeed introduce a confounding factor if participants interpret it as solely related to physical appearance and artificial attributes. Nevertheless, we believe that the other used items (i.e., "non-humanlike/humanlike," "unconscious/conscious," and "artificial/lifelike" contribute to the overall assessment of anthropomorphism beyond physical appearance and artificial attributes alone. The mean score of the four items is 4.36 suggesting that participants' responses leaned toward perceiving the VIs as more human-like, lifelike, natural, and conscious rather than in the direction of being fake, non-humanlike, unconscious, or artificial. This implies that the VIs were indeed perceived by participants as possessing anthropomorphic characteristics.

**Table 2**
AMOS results for the measurement model (N = 393).

| Constructs and measurement items | λ[a] | CA | CR | AVE |
|---|---|---|---|---|
| ***Anthropomorphism*** | | **0.906** | **0.91** | **0.71** |
| -[VI] is fake/natural | 0.89 | | | |
| - [VI] is non human-like/human-like | 0.84 | | | |
| - [VI] is unconscious/conscious | 0.78 | | | |
| - [VI] is artificial/lifelike | 0.86 | | | |
| ***Competence*** | | **0.941** | **0.94** | **0.75** |
| - I believe that [VI] is competent | 0.85 | | | |
| - I believe that [VI] is effective | 0.87 | | | |
| - I believe that [VI] is skilled | 0.90 | | | |
| - I believe that [VI] has the ability to implement its intention | 0.84 | | | |
| - I believe that [VI] is efficient | 0.87 | | | |
| ***Warmth*** | | **0.937** | **0.94** | **0.76** |
| - I believe that [VI] has good intentions toward customers | 0.89 | | | |
| - I believe that [VI] is warm | 0.88 | | | |
| - I believe that [VI] consistently acts with the customers' best interest in mind | 0.85 | | | |
| - I believe that [VI] is kind | 0.87 | | | |
| - I believe that [VI] is generous | 0.87 | | | |
| ***Willingness to follow the VI's recommendations*** | | **0.922** | **0.92** | **0.86** |
| - The likelihood that I would follow [VI] recommendations is High | 0.92 | | | |
| -The probability that I would follow [VI] recommendations is High | 0.93 | | | |
| ***Purchase intention*** | | **0.930** | **0.93** | **0.82** |
| - I would purchase products/brands promoted by [VI] in the future | 0.88 | | | |
| - I would actively seek out products/brands shown by [VI] to purchase them | 0.93 | | | |
| - I would buy products/brands endorsed by [VI] | 0.90 | | | |

CA stands for Cronbach's Alpha; CR stands for Composite Reliability; AVE stands for Average Variance Extracted.
[a] All factor loadings were significant at $p < .001$.

employed a common latent factor (CLF) method to contrast the factors loadings of the measurement model with and without CLF (Archimi and Bhatti, 2018). The largest difference is 0.111 (see Appendix 1), which falls under the cut-off value of 0.25 (Bryan, 2010). Thus, we can conclude that the risk of a common method bias is reduced in this study.

## 5. Findings

### 5.1. Measurement model

We used AMOS 24 to run a confirmatory factor analysis on the 19 items of the measurement model based on the pooled sample (N = 393). The results confirm that the measurement model shows excellent goodness-of-fit statistics, as evidenced by CMIN/DF = 1.45, IF = .99, TLI = .98, CFI = .99, RMSEA = .04. Table 2 summarizes the results of the measurement model.

The results show evidence of internal consistency as the composite reliability is above 0.70 across all measurements. The results also indicate that each of the 19 indicators loads respectively on its intended latent factor, providing support to the convergent validity (Fornell and Lacker, 1981). Besides, the variance extracted for each measurement is above the conventional cut-off value of 0.50, the same goes for the squared inter-factor correlations, lending support to the discriminant validity of measurements (Fornell and Lacker, 1981). All statistics are summarized in Table 3.

**Table 3**
Summary statistics and discriminant validity matrix (N = 393).

| Variable | ANT | COM | WAR | WTF | PIN |
|---|---|---|---|---|---|
| Anthropomorphism (ANT) | **.71** | | | | |
| **Competence (COM)** | .360 | **.75** | | | |
| **Warmth (WAR)** | .661 | .349 | **.76** | | |
| **Willingness to follow (WTF)** | .502 | .390 | .577 | **.86** | |
| **Purchase intention (PIN)** | .658 | .397 | .686 | .683 | **.82** |
| **Mean** | 4.36 | 4.20 | 4.38 | 3.80 | 3.87 |
| **Standard deviation** | 1.69 | 1.58 | 1.59 | 1.82 | 1.73 |

Values below the diagonal represent the correlations among the constructs and the diagonal elements (in bold) represent the average variance extracted from each construct.

### 5.2. Hypotheses testing of the direct and differential associations

To test H1, H2, H3, and H6, we estimated a structural equation model (SEM) for each VI, using AMOS 24. Furthermore, we have considered gender and age as covariates to control for their potential effects on both the willingness to follow the VI's recommendations and purchase intentions.

#### 5.2.1. VI 1: Shudu

The SEM results regarding VI 1 (Shudu) are presented in Table 4. The results indicate an acceptable fit model: CMIN/DF = 1.857, IFI = .95, CFI = .95, TLI = .94, RMSEA = .06. The model explains 34%, 15%, 42%, and 60% of the variances in warmth, competence, willingness to follow the VI's recommendations, and purchase intentions, respectively. The effects of the covariates (i.e., gender and age) on the willingness to follow the VI's recommendations as well as purchase intentions were not significant.

The results show that anthropomorphism is positively associated with warmth ($\gamma = .58$, t=7.92, $p < .001$) as well as competence ($\gamma = .33$, t= 4.34, $p < .001$), lending support to H1 and H2. As a post-hoc analysis, we used Chi-square ($\chi 2$) difference test to assess the significance of the differential association of VI's anthropomorphism with warmth versus competence by comparing $\chi 2$ value of the initial estimated unconstrained SEM to that of a constrained model. The coefficients' paths being compared are forced to be equal in the constrained model. The $\chi 2$ difference between the unconstrained and constrained model should be equal to or exceed the cutoff value of 3.85 to conclude on a significant difference between the two coefficients' paths into question. The results point to anthropomorphism to be positively more associated with warmth than competence. The $\chi 2$ difference test indicates that the

**Table 4**
SEM results for hypothesized model (VI1: Shudu).

| Effects of (exogenous) | On (endogenous) | $(\gamma/\beta)$[a] | t-value[b] | $R^2$ |
|---|---|---|---|---|
| Anthropomorphism | Warmth | 0.58 | 7.92 | 0.34 |
| Anthropomorphism | Competence | 0.33 | 4.34 | 0.15 |
| Warmth | Willingness to follow | 0.61 | 8.47 | |
| Competence | Willingness to follow | 0.18 | 2.80 | 0.42 |
| Likelihood to follow | Purchase intention | 0.77 | 10.95 | 0.60 |
| **Covariates** | | | | |
| Gender | Willingness to follow | −0.01 | −0.08 | |
| Age | Willingness to follow | −0.05 | −0.86 | |
| Gender | Purchase intention | 0.02 | 0.26 | |
| Age | Purchase intention | −0.03 | −0.02 | |
| **Goodness-of-fit statistics:** | | | | |
| CMIN/DF = 1.857 | | | | |
| IFI = .95 | | | | |
| TLI = .94 | | | | |
| CFI = .95 | | | | |
| RMSEA = .06 | | | | |

[a] AMOS coefficient path estimates.
[b] At $p < .001$.

difference is significant ($\Delta\chi2 = 5.47$, $p < .01$).

The willingness to follow the VI's recommendations is positively associated with warmth ($\beta = .61$, t = 8.47, p < .001) as well as with competence ($\beta = .18$, t = 2.80, p < .001). Particularly, the results indicate that the association between warmth and the willingness to follow the VI's recommendations is significantly stronger than that of competence and the willingness to follow the VI's recommendations. The $\chi2$ difference test between the unconstrained model and the constrained one indicates that the difference is significant ($\Delta\chi2 = 16.95$, $p < .01$). These findings lend support to H3. Lastly, the willingness to follow the VI's recommendations is positively associated with purchase intentions ($\beta = .77$, t = 10.95, p < .001). This lends support to H6.

#### 5.2.2. VI 2: Miquela

A SEM was estimated using AMOS 24. The results are presented in Table 5 showing an acceptable fit model: CMIN/DF = 2.017, IFI = .95, CFI = .95, TLI = .94, RMSEA = .07. The model explains 57%, 22%, 40%, and 43% of the variances in warmth, competence, willingness to follow the VI's recommendations, and purchase intentions, respectively. The effects of the covariates (i.e., gender and age) on willingness to follow the VI's recommendations as well as purchase intentions were not significant.

The results show that anthropomorphism is positively associated with warmth ($\gamma = .75$, t=11.63, p < .001) as well as competence ($\gamma = .40$, t=5.41, p < .001). These results lend support to H1 and H2. Meanwhile, the results indicate that anthropomorphism is positively more associated with warmth than competence. The $\chi2$ difference test indicates that the difference is significant ($\Delta\chi2 = 19.88$, $p < .01$).

Willingness to follow the VI's recommendations is positively associated with warmth ($\beta = .49$, t = 7.22, p < .001) as well as with competence ($\beta = .26$, t = 3.89, p < .001). Particularly, the results indicate that the association between warmth and willingness to follow the VI's recommendations is significantly stronger than the association between competence and willingness to follow the VI's recommendations. The $\chi2$ difference test between the unconstrained model and the constrained one indicates that the difference is significant ($\Delta\chi2 = 4.01$, $p < .01$). These results support H3. Finally, the willingness to follow the VI's recommendations is positively associated with purchase intentions ($\beta = .63$, t = 9.50, p < .001), which validates H6.

### 5.3. Hypotheses testing of the mediating roles of warmth and competence

To test H4 and H5, we used PROCESS macro model 4 (Hayes, 2022) to run a series of parallel mediation analyses, for each VI (see Table 6).

**Table 5**
SEM results for hypothesized model (VI2: Miquela).

| Effects of (exogenous) | On (endogenous) | $(\gamma/\beta)$[a] | t-value[b] | $R^2$ |
|---|---|---|---|---|
| Anthropomorphism | Warmth | 0.75 | 11.63 | 0.57 |
| Anthropomorphism | Competence | 0.50 | 5.41 | 0.22 |
| Warmth | Willingness to follow | 0.49 | 7.22 | |
| Competence | Willingness to follow | 0.26 | 3.89 | 0.40 |
| Willingness to follow | Purchase intention | 0.63 | 9.50 | 0.43 |
| **Covariates** | | | | |
| Gender | Willingness to follow | −0.09 | −1.43 | |
| Age | Willingness to follow | −0.04 | −0.58 | |
| Gender | Purchase intention | −0.07 | −1.19 | |
| Age | Purchase intention | 0.11 | 1.72 | |
| **Goodness-of-fit statistics:** | | | | |
| CMIN/DF = 2.017 | | | | |
| IFI = .95 | | | | |
| TLI = .94 | | | | |
| CFI = .95 | | | | |
| RMSEA = .07 | | | | |

[a] AMOS coefficient path estimates.
[b] At $p < .001$.

Anthropomorphism (X) was the independent variable, willingness to follow the VI's recommendations (Y) was the dependent variable, and warmth (M1) and competence (M2) were the parallel mediators.

When examining the linkages between anthropomorphism and the two stereotype dimensions, the results, in the case of the VI Miquela, show that anthropomorphism is positively associated with both warmth and competence (X →M1: $\beta = .6335$, $p <. 01$ and CI = [0.5431, 0.7258]; X →M2: $\beta = .3269$, $p < .01$ and CI = [0.2108, 0.4431]). This finding is also validated in the case of the VI Shudu: (X →M1: $\beta = .4961$, $p <. 01$ and CI = [0.3767, 0.6155]; X →M2: $\beta = .2974$, $p < .01$ and CI = [0.1639, 0.4309]).

When assessing the mediating role of warmth, the results, in the case of the VI Miquela, indicate that the bootstrapped confidence interval for the indirect association (X→M1→Y) did not include a zero CI = [0.1518, 0.4848], which means that the association between anthropomorphism and willingness to follow the VI's recommendations through perceived warmth is significant. Since the direct association between anthropomorphism and willingness to follow the VI's recommendations was not significant (X→Y: $\beta = -0.0009$, *ns*; and CI = [-0.1713, 0.1695]), then we can conclude that perceived warmth fully mediates the linkage between anthropomorphism and the willingness to follow the VI's recommendations, in the case of Miquela. However, the results in the case of the VI Shudu point to a partial mediation as both direct and indirect associations between anthropomorphism and willingness to follow the VI's recommendations are significant: CI = [0.2092, 0.5013] and CI = [0.0866, 0.3524], respectively. Therefore, H4 is supported; warmth mediates the linkage between anthropomorphism and willingness to follow the VI's recommendations.

Regarding the mediating role of competence, the results in the case of Miquela show that the bootstrapped confidence interval for the indirect association (X→M2→Y) did not include a zero CI = [0.0322, 0.1938]; thus, the association between anthropomorphism and willingness to follow the VI's recommendations through perceived competence is significant. Since the association between anthropomorphism and willingness to follow the VI's recommendations was not significant (X→Y: $\beta = -0.0009$, *ns*; and CI = [-0.1713, 0.1695]), then we can conclude that competence fully mediates the relationship between anthropomorphism and willingness to follow the VI's recommendations. Nevertheless, the results in the case of Shudu did not provide support for the meditating role of competence because the indirect association (X→M2→Y) was not significant (CI includes a zero value; CI = [-0.0154, 0.0951]). In light of these results, H5 is partially supported.

## 6. General discussion

### 6.1. Key findings

Drawing on the SCM, this research proposes and validates a conceptual model investigating the role of human-like VIs in shaping consumers' judgments and intentions. Overall, the study's findings lend support to the proposed hypotheses (H1 to H6). The results show that anthropomorphism is positively associated with warmth and competence judgments across both VIs, Shudu, and Miquela. Hence, H1 and H2 were supported. The results also provide evidence that warmth, compared to competence, is positively more associated with the willingness to follow the VI's recommendations, lending support to H3.

Furthermore, the mediating role of warmth has been supported. In fact, warmth fully mediates the relationship between anthropomorphism and willingness to follow the VI's recommendations in the case of both VIs, Shudu and Miquela. Thus, H4 is fully supported. However, the hypothesized mediating role of competence in H5 was partially supported. Competence mediates the linkage between the VIs' anthropomorphism and consumers' willingness to follow the VI's recommendations only in the case of Miquela (but not in the case of Shudu). A plausible explanation for such a finding could be the fact that the two VIs have different domains of expertise; while Shudu defines

**Table 6**
Mediation analysis: total, direct and indirect effects.

| | Miquela | | | | | | | Shudu | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | F(df) | $R^2$ | $\beta$ | SE | *t* | *LLCI* | *ULCI* | F(df) | $R^2$ | $\beta$ | SE | *t* | *LLCI* | *ULCI* |
| Total effect X on Y | 35.820 (1, 197) | .1539 | .4173 | .0697 | 5.985** | 2.798 | .5548 | 75.754 (1, 192) | .2829 | .5839 | .0671 | 8.703** | .4516 | .7163 |
| Direct effect X on Y | 34.160 (3, 195) | .3445 | −0009 | .0864 | −.0106 | −.1713 | .1695 | 40.310 (3, 190) | .3889 | .3553 | .0740 | 4.797 ** | .2092 | .5013 |
| Effect of X on $M_1$ | 183.55 (1, 197) | .4823 | .6335 | .0468 | 13.548** | .5413 | .7258 | 67.158 (1, 192) | .2591 | .4961 | .0605 | 8.195** | .3767 | .6155 |
| Effect of X on $M_2$ | 30.802 (1, 197) | .1352 | .3269 | 0.589 | 5.550 ** | .2108 | 0.4431 | 19.294 (1, 192) | .0913 | .2974 | .0677 | 4.3925** | .1639 | .4309 |
| Indirect effect through $M_1$ | | | .3133 | .0839 | | .1518 | .4848 | | | .1958 | .0681 | | .0866 | .3524 |
| Indirect effect through $M_2$ | | | .1049 | .0411 | | .0322 | .1938 | | | .0328 | .0283 | | −.0154 | .0951 |

X= predictor variable (Anthropomorphism), Y= criterion variable (willingness to follow the VI's recommendations), M1 = mediator 1 (Warmth), M2 = mediator 2 (Competence).
t not given for indirect effect.
$^{**}p < .01$.
LLCI = 5000 bootstrapped 95% lower-level confidence interval; ULCI = 5000 bootstrapped 95% upper-level confidence interval.
$\beta$, unstandardized regression coefficient, SE, standardized error.

itself as a top model, endorsing fashion brands, Miquela has a wide range of expertise, endorsing a variety of products, ranging from furniture to cars, etc. Lastly, the results show that consumer's willingness to follow the VI's recommendations is positively associated with purchase intention, providing support to H6.

### 6.2. Theoretical implications

This study makes relevant theoretical contributions to the emerging literature on human-like VIs. First, the study expands the SCM to the VIs context. While previous work has examined stereotypes associated with brands (Kolbl et al., 2020; Kervyn et al., 2012), companies (Aaker et al., 2010; Yang and Aggarwal, 2014), and advertising (Zawisza and Cinnirella, 2010; Lee and Oh, 2021), a scant of research has investigated stereotypes associated with social media influencers (Kim and Read, 2021; Kim and Read, 2022; Crisafulli and Singh, 2022), in particular VIs. As the influencer marketing domain continues to develop toward embracing virtual reality and metaverse environments (Dwivedi et al., 2022), examining whether the SCM still holds for virtual agents such as anthropomorphized VIs contributes to our knowledge of how consumers judge and respond to nonhuman entities. This is intriguing as previous work points out that humans, in general, tend to have an aversion and hostility toward nonhuman entities such as robots and machines (Wirtz et al., 2018; Chen et al., 2021).

While warmth and competence have been extensively studied in the context of human-human interactions, such as celebrities-consumers (Bauer et al., 2022) and service employees-customers (Zhou et al., 2021), limited research has been conducted on these dimensions in relation to interactions between human-like entities and humans (e.g., humanoid robots; Belanche et al., 2021), especially in relation to computer-generated characters such as VIs. Particularly, empirical evidence suggests that the believability of virtual agents is related to their perceived warmth and competence (Demeure et al., 2011). In this vein, the current research uses the SCM as a theoretical account to investigate how VIs are perceived by consumers in terms of warmth and competence. Furthermore, we extend the SCM by incorporating human-likeness (i.e., anthropomorphism) as a factor associated with warmth and competence perceptions of VIs.

This study confirms the existence of positions highlighting the appropriateness of the SCM for the context of influencer marketing and, in particular, extends it to a VIs context. Stereotypes as reflected by the judgment of warmth and competence are indeed positively associated with VI's anthropomorphism. Unlike previous work on brands, which indicates that humanizing brands influences warmth but not competence (Zhang et al., 2020), as well as relevant work on consumer robots (Kim et al., 2019) suggesting that heightened anthropomorphism enhances perceived warmth but not competence, the current study shows that anthropomorphism is positively associated with both warmth and competence.

Furthermore, the study provides insights into the socio-psychological mechanisms underlying the link between consumers' perceptions of VIs traits (i.e., anthropomorphism and stereotypes) and their behavioral intentions. The results from this research support the claim that both warmth and competence stereotypes play mediating roles by intervening in the association between anthropomorphism and the willingness to follow the VI's recommendations. Also, the results lend support to the "Primacy-of-Warmth Effect" claim in that warmth proved to be more associated with willingness to follow the VI's recommendations, compared to competence.

In addition, this study validates the nomological network leading from anthropomorphism through VI's stereotypes to intentional responses. Anthropomorphizing VIs would convey warmth and competence, which in turn, are positively associated with consumers' willingness to follow the VI's recommendations and their subsequent purchase intentions. Contrary to previous studies pointing to the uncanny valley effect (which refers to consumers' negative responses when VIs show human-like qualities) that would inhibit patronage intention (Lou et al., 2022), this study shows that anthropomorphism is associated with positive intentional responses in terms of consumers' willingness to follow the VI's recommendations and purchase intentions. This is in line with the CASA paradigm (Nass et *al.*, 1994) suggesting that individuals are prone to engage with robots as they do with social actors, even though they become aware of their lack of human feelings and motivations. While the uncanny valley theory coined by Mori (1970) has the merit to advance our knowledge about the effects of anthropomorphism associated with robots, one could question its relevance to nowadays' consumers. Indeed, as we transition to the metaverse and AI, consumers become more accustomed to nonhuman agents, as they are increasingly exposed to digital humans in virtual worlds (Silva and Bonetti, 2021) and anthropomorphized chatbots on online shopping websites (Zogaj et al., 2023).

### 6.3. Managerial implications

As metaverse and immersive technologies (i.e., virtual, augmented, and mixed realities) continue to develop, so will the rise of VIs (Dwivedi

et al., 2022; Dahan, 2022). To catch up with this trend, many advertising agencies (e.g., Dentsu VI, Uneeq) have begun offering services for creating VIs to endorse brands and promote products and services. Meanwhile, some brands such as Prada, and Samsung have also started developing their own VIs (Ypulse, 2022). The current research offers timely and relevant implications to marketers and VIs developers.

First, findings from this study echo the message that besides stereotyping brands, companies, and advertising, consumers also stereotype human-like VIs along the warmth and competence dimensions. Consumers make judgments about a VI's warmth and competence. As earliest impressions are critical to set the tone when establishing a relationship (Bergmann et al., 2012), VIs creators and managers need to carefully balance the VI's warmth and competence in order to cultivate a positive impression that would appeal to the audience. Needless to say, if a VI is perceived as cold (e.g., meaningless facial motion) and incompetent (e.g. absence or lack of arms and legs movements, and ancillary motions) by the audience, this would backfire and repulse consumers from the brand (Keegan, 2022). Along the same line, nailing a strong and appealing narrative in VI's social media posts and stories should also take into account the warmth and competence dimensions. For instance, posts with words and/or images eliciting love and passion would likely convey warmth, whereas posts about the product or brand performance would convey competence (Liu et al., 2021).

As creators of VIs have control over the VI's appearance, they are well-advised to not neglect the role of factors pertaining to the social psychology realm. That is, they need to be aware of the roles of warmth and competence when developing VIs. Compared to competence, warmth is more associated with consumers' willingness to follow the VIs' recommendations. This suggests that, when designing VIs' appearance, VIs' developers should focus primarily on integrating traits and attributes that evoke more warmth than competence. For instance, more attention should be paid to the inclusion of gentle smiles, eyes contact, and positive physical cues including leaning forward (e.g., showing interest and attentiveness), nodding, and open gestures (e.g., open palms) as these traits elicit openness, friendship, and trustworthiness, and would signal warmth (Nguyen et al., 2015). Meanwhile, cues conveying competence should be to a lesser extent evoked through, for example, gestures eliciting skills, assertiveness, and efficacy (Bergmann et al., 2012). Therefore, to implement VIs successfully, a delicate dosing of cues evoking warmth and competence must be struck.

### 6.4. Limitations and further research

The findings from this study should be examined in light of its limitations, which offer some potential avenues to advance research on the burgeoning domain of VIs. Although the relationships proposed in our model were theoretically grounded and validated through SEM and PROCESS analyses, we acknowledge that establishing causality has not been definitive in the current research. In fact, the data for this study were collected through a survey, which primarily establishes association rather than causation. To further validate the causal chain depicted in our conceptual model and provide stronger evidence for the study's findings, future research would benefit from adopting experimental designs. An experimental approach will be instrumental in firmly establishing that the VI's anthropomorphism is indeed the cause of the participants' judgments of the VI's warmth and competence as well as other downstream consequences. Furthermore, future research may consider replications by using an experimental design that accounts for different levels of anthropomorphism as well as by considering different types of products (e.g., technical vs. non-technical products; Franke et al., 2023).

As highlighted in the method section, ensuring that the respondents have a certain level of familiarity with VIs is likely to enhance the ecological or external validity of the study. However, familiarity with or pre-existing attitudes toward the selected VIs can, in part, account for the observed findings. Our proposed model precludes these two variables in that it did not rule out their potential effects. We recognize this issue as a limitation since our findings would be more robust if we have included pre-existing attitudes toward or familiarity with the selected VIs as covariates in our statistical analyses. In this vein, an experimental design based on "fictitious" VIs can overcome the limitation of the pre-existing attitudes that the participants may have toward "familiar" VIs.

Our study has specifically focused on Instagram users. It is important to acknowledge that participants with a strong affinity for Instagram may have pre-existing positive attitudes toward anything associated with the platform. This inherent bias could potentially influence their judgments of the VIs' warmth and competence. Furthermore, participants who are highly immersed in Instagram may hold different expectations or standards when evaluating VIs, as compared to those who are less immersed in the platform. In other words, participants' levels of immersion in Instagram are likely to influence their judgments and responses. To address these confounding factors, it would have been beneficial to include participants' preference for and immersion in Instagram as covariates in our statistical analyses. By considering these variables, we can better isolate and understand the specific effects of the VIs' anthropomorphism on participants' judgments, independently of their platform preferences and immersion levels.

Further research is also needed to enhance the generalizability of the study's findings. Our study has focused exclusively on the effects of anthropomorphism and stereotypes by considering only female human-like VIs. Further research should examine these effects by considering both male and female VIs across male and female audiences. Our study has focused exclusively on Instagram users. However, VIs audiences are also represented by VI fans on other social media platforms. To improve the generalizability of the study's findings, it would be interesting to investigate consumers' reactions to VIs with verified social media accounts on Twitter as a text-based media and TikTok as a video-based media (Deng and Jiang, 2023).

As most research on VIs has been conducted among consumers from Eastern cultures (Lou et al., 2022; Alboqami, 2023), additional studies are needed to examine the effects of anthropomorphism and stereotypes dimensions among consumers originating from Western cultures, as some research points to some cultural differences in anthropomorphism (Ghuman et al., 2015; Spatola et al., 2021). In the same vein, there is an urgent need for research to investigate the role of local versus global VIs in influencing consumer responses to VIs in the context of globalization.

## Declaration of Competing Interest

The authors declare that there is no conflict of interest.

## Data availability

The data that has been used is confidential.

## Appendices.

*Appendix 1. . Common Method Bias testing (N = 393)*

| Common Method Bias | | | |
|---|---|---|---|
| | Without CLF | With CLF | Δ |
| Ant_1 | 0.888 | 0.812 | 0.076 |
| Ant_2 | 0.837 | 0.834 | 0.003 |
| Ant_3 | 0.782 | 0.721 | 0.061 |
| Ant_4 | 0.856 | 0.835 | 0.021 |
| Comp_1 | 0.852 | 0.849 | 0.003 |
| Comp_2 | 0.873 | 0.872 | 0.001 |
| Comp_3 | 0.899 | 0.9 | −0.001 |
| Comp_4 | 0.838 | 0.837 | 0.001 |
| Comp_5 | 0.869 | 0.872 | −0.003 |
| Will_follow_1 | 0.923 | 0.809 | 0.114 |
| Will_follow_2 | 0.927 | 0.915 | 0.012 |
| Warm_1 | 0.886 | 0.82 | 0.066 |
| Warm_2 | 0.876 | 0.772 | 0.104 |
| Warm_3 | 0.853 | 0.879 | −0.026 |
| Warm_4 | 0.871 | 0.788 | 0.083 |
| Warm_5 | 0.873 | 0.762 | 0.111 |
| Pur_int_1 | 0.882 | 0.78 | 0.102 |
| Pur_int_2 | 0.929 | 0.852 | 0.077 |
| Pur_int_3 | 0.901 | 0.819 | 0.082 |

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