In Celebrities We Trust:

The Effects of Celebrity and Non-celebrity Digital Humans versus a Disembodied Chatbot on the Uncanny Valley Effect, Tool Evaluations and Political Measures during CAVAA Usage

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Technology Statement

1. I occasionally used Google Translate, Thesaurus.com and Merriam-webster.com for paraphrasing purposes.
2. Only Word's corrective features were used to correct spelling and grammar errors.
3. No typesetting tools were used.
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Abstract

Conversational Agent Voting Advice Applications (CAVAAs) have been proven to be an effective tool for increasing political knowledge among young adults (Kamoen & Liebrecht, 2022; Kamoen et al., 2022; Liebrecht et al., 2023). The purpose of this study was to ascertain what the effect of digital humans was on CAVAAs in terms of tool evaluations, political measures and embodiment measures. Participants were divided into three conditions, namely interacting with a disembodied CAVAA, a celebrity digital human CAVAA and a non-celebrity digital human CAVAA. To gather data, an experiment, a survey and interviews were conducted among university students (N = 81). The results showed that the disembodied CAVAA was considered easier to use by participants than the CAVAA with celebrity digital human. However, no further significant results were found. These results seem to suggest that digital humans have little impact on the CAVAA experience and should either be improved or reconsidered as an addition by chatbot developers.

Keywords: Conversational agent; Embodiment; Virtual avatars; Uncanny valley; Voting advice applications; Celebrity influence; Anthropomorphism; Social presence

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Introduction

Young adults seem to show relatively little interest in politics. Roughly 40% of Dutch young adults have indicated they were fairly to highly interested in politics (CBS, 2019). When specifically asked about Dutch politics, only 30% showed interest (UvA, 2023). This lack of interest can be damaging for democracy due to underrepresentation, as research has shown that a lack of political knowledge can lead to lower turnout rates (Petričević & Stockemer, 2019). Another worrisome trend is that a group of young, potential voters frequently uses social media as a source for their news (Marquart et al., 2020) and has shifted away from other news sources such as television (Mitchell, 2020). Moreover, they use social media as a platform to discuss political matters (Matthes, 2022). This shift could be detrimental for the cultivation of political attitudes in young adults, as social media is rife with fake news (Konopliov, 2023). Such fake news could cause young adults to feel cynical towards politics, which could lead to political disengagement (Yamamoto et al., 2016).

Methods such as Voting Advice Applications (VAAs) have been tested in attempts to increase young adults' political interest in safer ways. Usually, most people prefer consulting digital VAAs to discover who they should vote for (Meijer, 2023). VAAs have proven to be effective at increasing turnout rates, but they could still be improved (Fivaz & Nadig, 2010; Germann & Gemenis, 2018). In that regard, recent studies (Kamoen & Liebrecht, 2022; Kamoen et al., 2022; Van Zanten & Boumans, 2024) have introduced a new addition to VAAs by combining them with conversational agents. These are called Conversational Agent Voting Advice Applications (CAVAA). For instance, these CAVAAs can come in the form of chatbots that inform users about relevant political matters as they fill out a test to ascertain the party that best matches their political orientation. In two prior studies by Kamoen and Liebrecht (2022), these chatbot CAVAAs have been shown to be an effective tool. Participants who used a CAVAA self-reported and demonstrated higher political knowledge on tests than those who did not. Furthermore, the interaction with the chatbot increased the participants' satisfaction with the VAA experience.

Moreover, previous research has shown that chatbots with higher anthropomorphism (i.e., human-like) levels made participants more inclined to vote (Kim & Lee, 2023). In general, human-like features seem to work well for chatbots. For instance, a study using 2D human-like avatars showed it increased their perceived interaction quality (Kim & Lee, 2022). However, the avatar used in this study was two-dimensional and lacked animations, falling short of the human-like potential of digital avatars. Therefore, this study will use an animated three-dimensional digital human for comparison. Digital humans are chatbots that

speak through a realistic 3D model of a human (i.e., they are embodied), which are also equipped with animations simulating human behaviour (e.g., head and eye movements). Digital humans are able to respond in a way that is just human enough, while also giving off the impression that they are living beings just like us, living their own lives (Silva & Bonetti, 2021). As such, they are highly anthropomorphic machines that can potentially amplify the previously found positive effects relating to anthropomorphised chatbots. Digital humans also score higher on social presence, which refers to the feeling of interacting with a real person in virtual environments (e.g., Lee et al., 2019). This way, the addition of digital humans could further optimise the CAVAA experience.

However, the highly anthropomorphic nature of digital humans also has a possible downside to it due to them entering uncanny valley territory. The uncanny valley effect is a psychological phenomenon that describes the discomfort or unease people feel when they encounter something that closely resembles a human, yet is not quite convincingly human. This effect could arise when people interact with digital humans, because their added graphics and animations are imperfect and could seem eerie and machine-like.

Through the interplay between anthropomorphism and the uncanny valley, digital humans could bring about an array of effects in their users. The type of digital human used might also be an influential aspect. For instance, digital humans modelled after celebrities could have a mitigating effect on the uncanny valley due to their familiarity (Destephe et al., 2015; Song & Shin, 2022). Familiarity is seen as an antipode to feelings of eeriness and can elicit warm reactions (Destephe et al., 2015; Mori, 1970). Moreover, people can regard celebrities as more trustworthy, because they are attractive and assumed to have expertise (Hussain et al., 2020; Leclercq et al., 2023). In the last decade, celebrity endorsement has been a prevalent marketing strategy, which has also extended to virtual celebrities (e.g., Arsenyan & Mirowska, 2021; Baig & Siddiqui, 2012; Torres et al., 2019).

This study intends to compare the effects of a digital human avatar of a celebrity and non-celebrity person on the CAVAA experience of participants. For this purpose, political knowledge, voting intention and tool evaluations (i.e., ease of use and usefulness) will be used as performance metrics. Moreover, the degree to which the two types of digital human elicit the uncanny valley effect and social presence will be measured. The uncanny valley effect is usually measured through anthropomorphism, eeriness, attractiveness, likeability and trustworthiness scales (Kim et al., 2022), thus these will be employed as variables in this study. This leads to the following research question: “What are the effects of celebrity versus non-celebrity digital humans versus a disembodied chatbot on political measures, tool

evaluations, the uncanny valley effect and social presence during CAVAA usage?" The results of this study add to the existing basis of CAVAA research by introducing celebrity and the uncanny valley effect in this political context for the first time. Based on this information, future design efforts for CAVAAs will be able to take a more optimal approach. With motivating factors like celebrity endorsements or mitigation of uncanny valley effects in CAVAAs, the political knowledge and voting turnout of young adults will hopefully increase by interacting with these technologies. Moreover, the results will build further on the celebrity digital human research by Song and Shin (2022) by observing if similar effects appear while using a different celebrity and context. This will help discern potential confounding variables that could hinder the effectiveness of celebrity digital humans.

Theoretical Framework

Political Chatbots

Previous literature has explored the potential benefits of utilizing chatbots as assistants for people that are filling in voting advice alignment tools (e.g., Kamoen & Liebrecht, 2022; Kamoen et al., 2022; Liebrecht et al., 2023; Van Zanten & Boumans, 2024). These chatbot-assisted voting advice applications were aptly named CAVAAs, which is an abbreviation of the former. Kamoen and Liebrecht (2022) have compared the usage of a standard VAA versus a CAVAA between people with different educational levels, prior political knowledge and political interest. They found that participants with higher levels of political knowledge and interest, which correlated to a higher educational level, answered factual political knowledge questions better and felt more inclined to vote. Increasing political knowledge is important, as a lack thereof is one of the main reasons people refrain from voting (Delli Carpini & Keeter, 1996). Moreover, in the study by Van Zanten and Boumans (2024) the CAVAA had a positive effect on the participants' self-reported political knowledge. However, the participants who interacted with the CAVAA had lower intentions to vote than those who interacted with the normal VAA. All in all, chatbots can be seen as a valuable addition to VAA tools, but the design must be further optimized to mitigate possible negative effects.

Furthermore, Kamoen et al. (2022) and Liebrecht et al. (2023) have done research into such optimizing design choices for CAVAA. In general, a structured chatbot (i.e., no text field, buttons only) that communicates to participants via text only seems like the best choice. For people with lower education levels, a structured chatbot is best, as they can perceive these as easier to use. Interestingly, structured chatbots are seen as more playful by people of high and low education. People find playfulness to be a key motivator for using chatbot technologies, making it an important aspect of the CAVAA user experience (Brandtzæg & Følstad, 2017; Van de Pol et al., 2014). A structured design is also able to mitigate possible miscommunication, which could detract from the enjoyment of using chatbots (Kamoen et al., 2020). As for the chatbots' best method of communication, text-only seems to be the most appropriate in a CAVAA-context. The voice-only CAVAA was evaluated worse by participants in terms of ease of use and usefulness. Additionally, people were less likely to request the voice-only CAVAA for information and experienced more miscommunication. Possible reasons for this discrepancy were a fear of miscommunication among the participants and voice communication being too strenuous (Liebrecht et al., 2023).

Overall, well-designed conversational agents like chatbots can bring an array of positive effects with them due to their human-like nature and their added functionalities. The groundwork with which these effects can be explained is the Computers are Social Actors (CASA) paradigm (Nass & Moon, 2000).

Computers are Social Actors Paradigm

The Computers are Social Actors (CASA) paradigm is frequently used to explain the relationship between humans and technology. According to CASA, humans mindlessly apply social scripts when having conversations with technology, treating them in a human-like way (Nass & Moon, 2000). Whether or not people are aware of the fact they are interacting with a machine does not seem to matter for the workings of the CASA paradigm (García & Lopez, 2019). Humans socially react to machines even when they have limited or basic social cues (Lee & Nass, 2010). However, recently researchers have argued through the *Media are Social Actors paradigm* (MASA) that people do actively treat technological entities more socially when they have built-in social cues (Lombard & Xu, 2021).

In the present study, the face of the embodied chatbot could function as an influential social cue. An explanation for this is that a technological actor's visual and behavioural realism can increase the degree of social presence that people feel (Fitton et al., 2020). Social presence refers to the degree to which people feel they are interacting with and in the presence of a real person. For instance, interactions via e-mail generally have a low degree of social presence, since the communicating parties only have access to a limited number of each other's social cues. On the other hand, virtual reality has a high degree of social presence, since it affords its users to experience their interlocutors' social cues in abundance (Oh et al., 2018).

As each technology brings different affordances and gives off different social cues, the capacity to facilitate this human-like social presence differs between technologies. Technologies with a higher degree of social presence can lead to more engagement, trustworthiness, brand attitudes and enjoyment (Jin, 2011; Liebrecht & Van Der Weegen, 2019; Liew & Tan, 2018). Additionally, they also socially influence and persuade people more easily, even if they look unattractive (Skalski & Tamborini, 2007). Furthermore, research has shown that anthropomorphic technology significantly stimulates more social presence than others (Kim et al., 2020; Ruiz-Equihua et al., 2022).

Anthropomorphism

Anthropomorphism refers to the attribution of human-like features (e.g., shapes, characteristics and behaviours) to nonhuman objects or animals (Waytz et al., 2013).

Anthropomorphism generally leads to positive evaluations of tools and thus also has a linear effect on the perceived competence and trustworthiness of technological actors (Gong, 2008). In general, humans give preference to anthropomorphic actors over all other types (Kontogiorgos et al., 2019). Anthropomorphism is one of the main factors determining how people evaluate technological actors (Gong & Nass, 2007). Previously, research has focused on making conversational agents more human-like to reap its benefits. Adding social cues to conversational agents like greetings, a varying pitch while speaking and facial expressions can increase the anthropomorphism levels that people experience (Feine et al., 2019). The more people perceive chatbots to have a mind, the more they perceive higher degrees of social presence, closeness and intentions to use them (Lee et al., 2019). A business-context study by Araujo (2018) illustrated that solely giving chatbots a name and human-like language usage can make people perceive them as more human-like. Moreover, contrary to Kim et al. (2020) and Ruiz-Equihua et al. (2022) no significant effect of anthropomorphism on social presence was found. However, when human-like chatbots disclosed they were intelligent, participants perceived them as significantly more socially present than intelligent machine-like chatbots.

Similarly to the aforementioned CAVAA research, Kim and Lee (2022; 2023) have studied the effects of the humanization of chatbots in a political campaign context with two studies. In order to humanize their chatbots, they used a static photo of a political person. In their studies they compared chatbots with higher and lower levels of human-likeness, factual versus emotional chatbot messages and message interactivity. Participants who interacted with the highly human-like chatbot showed a greater intention to vote than those who interacted with the less human-like chatbot. Additionally, the positive effect for highly human-like chatbots was enhanced when they sent emotional messages. For highly human-like chatbots, no significant effect of message interactivity was found.

Since the aforementioned studies solely regarded disembodied chatbots or static 2D avatars, the question arises: How would digital humans, that have higher anthropomorphism and social presence than chatbots, perform in a political context?

Digital Humans

Digital humans are highly realistic, computer-generated representations of humans that are designed to simulate the appearance, behaviour, and interactions of real humans. These digital entities are constructed using realistic digital graphics and animation rigging to achieve lifelike visual fidelity and dynamic responsiveness. Their purpose is to enhance

virtual experiences by adding a social dimension that is beneficial for users (Hanus & Fox, 2015). Digital humans have been utilized in many avenues, among which the videogame and film industry, customer support, coaching and e-commerce (Deloitte, 2022). Digital humans are even used as virtual influencers to promote products and services (e.g., Da Silva Oliveira & Chimenti, 2021).

People are interested in and motivated to interact with digital humans according to research by Silva and Bonetti (2021). Virtual agents should be humanized if technology with high social presence is used. When virtual agents like digital humans are anthropomorphised, this can help users feel less uncertain when interacting with them due to higher levels of perceived social presence (Schroeder & Epley, 2016). The higher the degree of social presence, the more similar interactions with digital humans are to human-to-human communication (Edwards et al., 2019). Additionally, according to a growing body of research (Koda & Maes, 1996; Tastemirova et al., 2022; Thepsoonthorn et al., 2021), non-verbal behaviour is a crucial aspect of conversational agents like digital humans. Because digital humans have facial expressions, people conversing with them can better predict their behaviour, which improves engagement and social presence (Koda & Maes, 1996). Moreover, digital humans can make the interactions more informative and fun (Silva & Bonetti, 2021). Digital humans can also be better at establishing rapport with humans than faceless chatbots (Lucas et al., 2017). Additionally, some studies have linked anthropomorphism and social presence to increased engagement with conversational agents (Moriuchi, 2020; Tsai et al., 2021) To illustrate, research into an embodied virtual medical assistant has shown that people had considerable engagement rates, combined with high trust and acceptance levels for the digital human (Philip et al., 2020).

In sum, digital humans are more anthropomorphic than disembodied chatbots. Higher levels of anthropomorphism can lead to more engagement (Lee et al., 2019; Moriuchi, 2020), intention to vote (Kim & Lee 2022; Kim & Lee 2023) and social presence (Lee et al., 2019). In turn, higher levels of social presence can improve engagement too (Tsai et al., 2021), as well as trust, brand attitudes and enjoyment (Jin, 2011; Liebrecht & Van Der Weegen, 2019; Liew & Tan, 2018). Since these studies were performed in different contexts, the question arises as to whether digital humans will also be beneficial in the realm of political CAVAAs. The addition of a digital human to a CAVAA could lead to more positive evaluations of the tool and possibly more political knowledge and voting intention through people being more motivated to engage with the CAVAA. The present study will attempt to answer that question by incorporating digital humans into CAVAAs for the first time. In terms of benefits, the

present study expects that the CAVAAs with digital humans will to lead to higher levels of political knowledge and voting intention among participants. This leads to the following hypothesis:

H1: *Participants in the digital human condition will rate their perceived political knowledge and voting intention higher than those in the disembodied chatbot condition.*

Uncanny Valley

While higher degrees of anthropomorphism in conversational agents can lead to positive outcomes, it can also be a double-edged sword due to the uncanny valley effect (MacDorman, 2019; Mori, 1970; Stein et al., 2020). The uncanny valley effect describes that people can feel uneasy when interacting with technology that appears human-like, but also falls short of realism (e.g., due to choppy movement or design flaws). Researchers have suggested that people experience this effect when preconceived notions they have in their minds about human-like entities are violated (Saygin et al., 2011). Feelings and concepts related to the uncanny valley are eeriness, anthropomorphism, attractiveness, likeability, trustworthiness and social presence (Ho & MacDorman, 2016). The uncanny valley was first discovered in the field of robotics by Mori (1970), where they developed robots that took on human forms. While these robots appeared realistically human-like at first, upon further inspection their artificial imperfections became apparent and caused feelings of uncanniness. Two types of uncanny valleys seem to exist according to research by Kim et al. (2022). The first regards entities that are highly human-like and is most fitting for the present research, while the other gets triggered by medium human-like entities. As both valleys lead to different evaluations, the study concludes that the uncanny valley theory is best used to understand how to avoid designing features that trigger it, rather than improving the positive perceptions of human-like entities.

Research has further backed up the uncanny valley theory, showing effects such as reduced trustworthiness for human-like robots (Mathur & Reichling, 2009) and virtual faces (McDonnell et al., 2012). Humans also have less trust in robots that subtly change their facial expressions, for example, through eyebrow raises (Mathur & Reichling, 2009). As such, robots and other technologies can freely reap the benefits of appearing human-like up to a certain point, after which they fall into the uncanny valley and evoke negative feelings. Technically, it is possible to avoid the uncanny valley by immaculately designing human-like features, but the slightest flaw can make a technology fall back into the valley (Kim et al., 2022).

When humans interact with digital humans, the uncanny valley effect may also occur. Previous research on human-chatbot interaction has shown that embodied chatbots were perceived more negatively due to the uncanny valley effect (Ciechanowski et al., 2019; Thaler et al., 2020). Moreover, research has suggested that more realistic avatars cause participants to experience more feelings of eeriness (Bouwer & Human, 2017; Shin et al., 2019). Shin et al. (2019) followed a 2x2 design in their study, comparing two degrees of realism (Cartoonish vs. Hyper-realistic) and animacy (Still vs. Animate). A combination of both the realistic and animated variables induced a feeling of eeriness in the participants, but in the cartoonish condition animacy only had a negligible effect. Moreover, the eerie feelings subsequently led participants to less accurately evaluate the avatars on extraversion and agreeableness. Since motion (e.g., animacy) is also related to the uncanny valley and can exacerbate its effects (Mori et al., 2012), the non-verbal behaviour of digital humans should be designed carefully to avoid feelings of eeriness. According to an experiment with virtual humans, motion was found to influence the familiarity and appeal of the avatars (McDonnell et al., 2012). Moreover, digital humans using expressions that are too intense can lead people to feel uncanny valley-related feelings, whereas using none at all negatively impacts human likeness (Tastemirova et al., 2022).

Research has also indicated that people do not always perceive higher levels of social presence when conversing with realistic human models as opposed to cartoonish ones in virtual environments (Jo et al., 2016, as cited in Yoon et al., 2019; Yoon et al., 2019). This could happen when the human-like models are imperfect and subsequently fall into the uncanny valley (Jo et al., 2016, as cited in Yoon et al., 2019; Saygin et al., 2011). Furthermore, research has shown that people evaluated videos of a human travel agent more positively compared to virtual avatars in terms of trustworthiness, affinity and preference (Seymour et al., 2020). However, a field study by Seymour et al. (2021) that compared a highly realistic digital human with a cartoonish human found opposing results. Participants showed greater levels of trust and affinity towards the realistic model and preferred it over the cartoonish design. A recent study (Bae et al., 2024) comparing meta-humans and digital humans could explain this differing result. Meta-humans are a more advanced type of digital human that uses better technology to ascertain higher levels of realism. The study revealed that meta-humans gained more acceptance from participants and were rated higher in terms of social presence and human-likeness. These results suggest that more advanced 3D human models can indeed overcome the uncanny valley effect. Additionally, a study by Kätsyri et al.

(2019) has argued that digital humans modelled with CG only cause a lesser uncanny valley effect (i.e., the uncanny slope) in people compared to less realistic avatar models.

Since the present study utilizes realistic, animated avatars, participants will likely experience a certain degree of uncanny valley related feelings. Subsequently, this might cloud their judgment of the personality traits of the avatars (Ciechanowski et al., 2019; McDonnell et al., 2012; Shin et al., 2019; Thaler et al., 2020). Additionally, participants might get distracted or hindered by their uncanny feelings, possibly leading to worse tool evaluations. This has led to the following hypotheses:

H2: *Participants in the digital human condition will evaluate the CAVAA tool more negatively than participants in the disembodied chatbot condition. This effect will be mediated by the uncanny valley.*

Celebrity Effects

Celebrities could function as an antidote to the uncanny valley effect (Mori, 1970; Song & Shin, 2022). As the creator of the uncanny valley assumed, when people perceive more familiarity towards an entity (e.g., in the case of celebrities), it is subsequently perceived as less eerie (Destephe et al., 2015; Mori et al., 2012). Celebrities, with presumedly high levels of familiarity, can thus function as potential mitigators of the uncanny valley effect. Song and Shin (2022) have previously conducted research into the effects of the familiarity and humanization of chatbots on uncanny valley feelings and engagement intentions. They compared a realistically-animated digital human chatbot to a cartoonish chatbot without animations. These chatbots were either modelled after the celebrity Tom Cruise or an unknown person. Participants were instructed to interact with the chatbot in an e-commerce setting by pretending they had to buy a laptop with its assistance. They found that more human-like avatars had a negative effect on trust and engagement intentions. Additionally, familiarity had a significant moderation effect on the relationship between humanization and eeriness. Specifically, more familiar avatars weakened the negative effects of the uncanny valley. Participants in the celebrity avatar condition had a significantly lower feeling of eeriness compared to the unknown avatar condition. The difference in results for the celebrity avatar is in accordance with Mori's (1970) theory and can be explained further through literature regarding celebrity endorsement.

Celebrity endorsement is one of the most prevalently used marketing strategies worldwide (Baig & Siddiqui, 2012). Celebrity endorsements are an effective tool to improve

the performance of a brand. Previous research has shown that a positive relationship exists between attitudes towards celebrities and attitudes towards brands (e.g., Amos et al., 2008). In celebrity endorsement literature, several endorsement theories have been constructed to explain its effectiveness.

The source attractiveness model demonstrates that physically attractive people can more effectively change the attitudes of individuals (Chaiken, 1979). Endorsers with an attractive appearance can arouse people through sensuality, which impacts the receiver's information processing and leads to more favourable evaluations (Roozen & Claeys, 2010). However, the attractiveness of endorsers has been found to not only be limited to physical attractiveness. Other relevant dimensions such as similarity, familiarity, and likeability have also been shown to be important facets of attractiveness; People evaluated as most attractive will also score highly on these facets (McGuire, 1985, as cited in Schimmelpfennig & Hunt, 2019). Attractive celebrities are also seen as more trustworthy and subsequently more credible (Hussain et al., 2020; Leclercq et al., 2023). The source attractiveness model is a possible explanation for why the digital human modelled after the generally attractive actor Tom Cruise evoked less uncanny valley-related feelings in the study by Song and Shin (2022).

Furthermore, The match-up hypothesis argues that endorsers can be most effective when people perceive the endorsers, brand and target audience to be congruent (Mowen et al., 1979). Higher degrees of congruence can lead to more positive brand attitudes, whereas if the congruence between a celebrity and brand is absent this could likely lead to negative evaluations (Korchia et al., 2012; Lafferty, 2009). Similarly, the meaning transfer model argues that celebrity endorsements are effective because they are able to transfer cultural meanings through their identity to people (McCracken, 1989). Celebrities can have refined meanings associated with them (e.g., social standing and lifestyle) that they can transfer to products when endorsing them. In turn, people are innately able to recognise these symbolic meanings and will thus be able to grasp and link them to the endorsed product (McCracken, 1989).

Research into virtual influencers by Torres et al. (2019) has shown that they can influence brand attitudes and purchase intention through attractiveness (i.e., likeability and familiarity) and through congruence with brands they are endorsing. Virtual influencers could be better at promoting utilitarian products (e.g., laptops) than humans, because people perceive their recommendations as more useful (Belanche et al., 2024). Moreover, the results of Torres et al. (2019) suggested that congruence was more influential than attractiveness on

both brand attitudes and purchase intention. However, they also noted that attractiveness can positively influence the perceived congruence between a virtual influencer and brands, meaning attractiveness still plays an important role. These results show how virtual influencers can transfer their associated meanings (e.g., attractiveness) over to brands. Furthermore, Li et al. (2023) also found that a congruent fit between digital humans and the product they are endorsing is important. However, Brown (2020) found opposing results; while virtual influencers did increase purchase intentions, this was not enhanced by their congruency with the brand.

Considering the literature above, celebrities seem to garner more positive evaluations from the public compared to regular humans (e.g., Amos et al., 2008; Song & Shin, 2022; Torres et al., 2019). Moreover, his influence can function as an antidote to eeriness as demonstrated by Song and Shin (2022). Thus, the celebrity digital human utilised in this study is expected to garner less negative evaluations from participants. Since the present study uses a sports presenter as its celebrity endorser, one could wonder how congruent this choice would be with a political tool. Based on the research by Brown (2020) and that virtual influencers could be better at promoting utilitarian products (Belanche et al., 2024), the celebrity is expected to have a decent congruence with the CAVAA. Therefore, the following hypothesis has been devised:

H3: *Participants in the celebrity digital human condition will experience significantly less uncanny valley feelings and more social presence and likeability than those in the non-celebrity condition.*

Method

Design

To test what the effects of a celebrity versus non-celebrity digital humans versus a disembodied chatbot on the CAVAA experience are, a three condition between-subjects design was used. The effectiveness of the CAVAA was evaluated through tool evaluations (ease of use and usefulness) and political measures (political knowledge and voting intention). Moreover, comparisons between the two digital human conditions were made on embodiment measures. The studied dependent variables related to the digital humans were the degree of uncanny valley-related feelings (Eeriness, Anthropomorphism, Attractiveness, Likeability, Trustworthiness & Social Presence). Data was collected via an ***experiment, a survey and a series of short interviews***. To assess the effect, t-tests, ANOVAs and a mediation analysis were used.

Participants

The target demographic of this study was young adults. This group is ideal for this experiment, because they are allowed to vote, but also have a lower political turnout as described in the introduction. Recruitment of this demographic was realised by recruiting participants on the campus of Tilburg University. A total of 81 participants were recruited in this way, in order to have above 20 participants per condition. Of this group, 40 (49.4%) of participants identified as male and 39 (48.1%) as female. Additionally, 1 (1.2%) person identified as non-binary. On average, participants indicated they were somewhat interested in politics (M = 5.21, SD = 1.37). People who participated in this research were compensated with either SONA credits or sweets, depending on their wishes.

Materials

Two digital humans were used during the experiment, which were made with an animation software tool called Crazy Talk 8, similarly to the study by Shin et al. (2019). The celebrity digital human was modelled after Gert van ‘t Hof, who is a Dutch sports journalist with a television presence (see Figure 1). The non-celebrity digital human was modelled after a stock photo model found on the website iStock (see Figure 2). Differences between the two digital humans were kept as small as possible, in order to avoid potential confounding variables. With this in mind, the models were both male, looking similar in age and given the same hairstyle and outfit. Additionally, human-like animations were added to make the avatars as human-like as possible. They made natural upward and downward movements with their heads, occasionally blinking and staring at the participants. Moreover, they also possessed three behavioural responses to questions posed by participants, namely smiling,

nodding and frowning (upon processing errors). These animations were kept on the subtle side, as intense expressions could trigger uncanny feelings in participants (Tastemirova et al., 2022).

The chatbot functions for both the digital humans and the disembodied chatbot were made with Rasa, which is a platform for building generative conversational AI assistants. Its development was outsourced to chatbot developer GeniusVoice. The interface they built consisted of two layers (see Figure 3 and 4). In the first layer on the top side of the screen, 18 political statements were given with three answer buttons below (Agree, Neutral and Disagree). Upon answering, a new statement appeared in the same place.

The second layer contained a sizeable chat box, accompanied by the digital human on the left side. Participants were able to input text into the chat bar above the chat box, whereas the chatbot used the chat bar below it. Additionally, messages from the participants were displayed on the right-hand side and messages from the chatbot on the left-hand side. These chat design options were chosen in order to create the feeling for the participants that they were conversing with a real human in a standard digital manner.

To make the VAA as realistic and effective as possible, real statements and political party views of the upcoming European elections (2024) were used. These were acquired from the citizen-empowering political organisation ProDemos and handled confidentially by signing a non-disclosure agreement. The chatbot's descriptions and answers were kept neutral, so that participants could form their own opinions and so that its trustworthiness was not harmed. Furthermore, all the answers provided by the chatbot regarding these political matters were written by humans. Pre-formulated questions were also available for participants to use, in the form of clickable buttons. These buttons included information about party positions, which was gathered from the VAA-application Stemwijzer. Additionally, information about the meanings of difficult words and the status quo was available. These were written by researchers and based on reputable sources like government websites. Lastly, the chatbot was able to give an overview of the pros and cons of what would happen if a certain political measure was enforced. This enabled participants to quickly access (counter)arguments about the subject in question as food for thought. Moreover, the chatbot was trained by our researchers using a specific set of information, rather than self-generative AI language models. However, the chatbot did utilize a dictionary database with words that were relevant to the topic. This allowed the chatbot to recognise many synonyms that participants might have used when conversing with it. Subsequently, the chatbot made fewer mistakes which could hurt the flow of the conversation.

Figure 1

Celebrity Digital Human

Figure 2

Non-Celebrity Digital Human

Figure 3

Digital Human CAVAA Interface

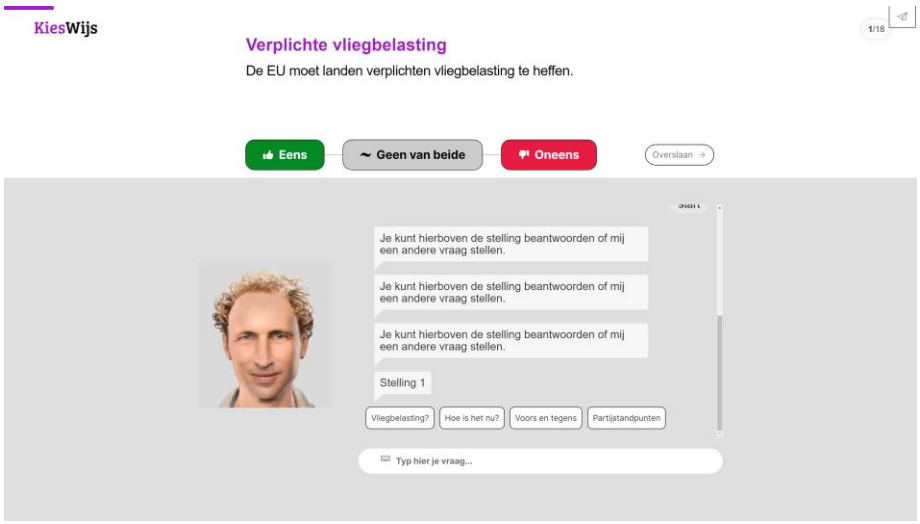
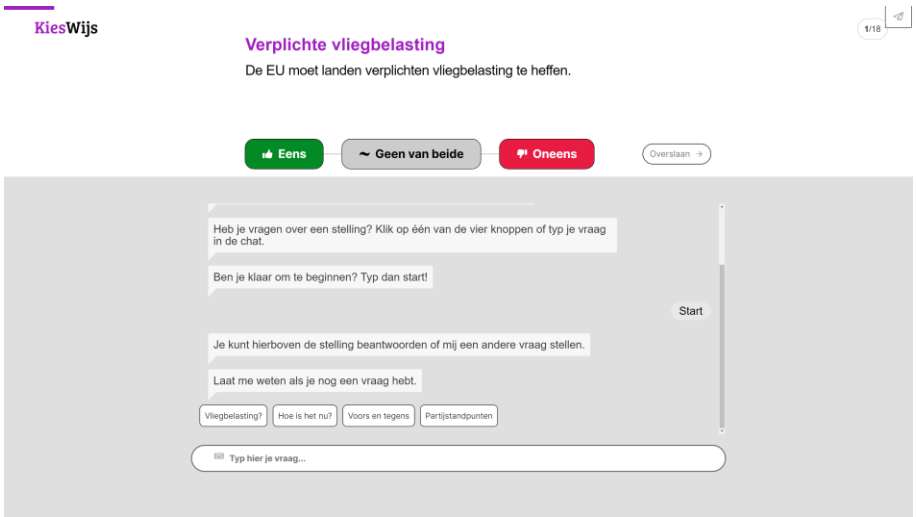


Figure 4

Disembodied Chabot CAVAA Interface



Measures

To gather data, an experiment, followed by a survey and interview were conducted. Since the experiment already included a long task, the survey and interview were intentionally kept short to avoid disinterest. All the materials were in Dutch and have been translated to English for readability purposes. Refer to Table 2 for the definitive list of constructs used for the analyses and their respective statistics.

The survey first asked the participants about political measures, specifically if they were allowed to vote and if they were going to do so for the upcoming election. Moreover, participants were asked to what degree the CAVAA improved their Political Knowledge on a 7-point Likert scale (1 = Completely disagree, 7 = Completely agree). Political Knowledge contained the following three items: " This tool has given me more knowledge about the political landscape", "The tool has motivated me to delve further into politics" and "By completing the tool, I know better which political themes surrounding the European Parliament elections are important.".

Next, constructs regarding tool evaluations were measured. The first construct therein was Ease of Use. This measure describes how easily users are able to interact with a product and was measured with the following two statements: "I thought the tool was easy to use" and "It didn't cost me any effort to use the chatbot.". The second construct was Usefulness. This construct measured if the CAVAA helped people to get closer to their goals with two statements: "I thought the tool was helpful" and "I thought the tool was convenient".

The following subset of six embodiment constructs related to the uncanny valley were measured for comparison between the digital human conditions. The first construct was Eeriness, which measured the degree of how uncanny people thought the digital humans were with the following two items based on a study by Ho and MacDorman (2016): "I thought the avatar was freaky" and "I thought the avatar was weird". Secondly, Anthropomorphism was based on the study by Powers and Kiesler (2006) and measured how human-like people thought the digital humans were. "I thought the avatar looked real." and "I thought the avatar looked human-like.". Third, Social Presence was based on survey items made by Liebrecht and Van der Weegen (2019) and refers to the degree to which people feel like they are talking to a real person online. The items were: "Contact with the avatar felt personal." and "Contact with the avatar felt social." Fourth, Attractiveness was measured with items based on Ho and MacDorman (2016) "I thought the avatar was beautiful." and "I thought the avatar was agreeable." Fifth, Trustworthiness was based on McKnight et al. (2002) and measured with "I thought the avatar seemed trustworthy." and "I thought the avatar had good intentions.".

Sixth, Likeability was based on Reysen (2005) and measured with the items “I thought the chatbot was friendly.” and “I thought the chatbot was sympathetic.”

Additionally, familiarity with the digital human was measured with a Y/N question. Lastly, people were asked to disclose their gender and what their overall interest in politics was on a 7-point Likert-scale (1 = Completely disinterested, 7 = Completely interested).

The interview followed a structured design that consisted of three main questions that corresponded to hypothesis 2. Interviewees were asked how they experienced the CAVAA, with specific regard to whether the chatbot was a valuable addition to the VAA. Next, they were asked how the CAVAA could be improved. Lastly, people in the disembodied chatbot condition were asked if they would have preferred a digital human. In the digital human condition, the opposite was asked. Data from the interview was thematically analysed in Google Spreadsheet following a deductive approach.

Factor Analysis

To assess the dimensionality of the embodiment measures, an Explanatory Factor Analysis (Principal Axis Extraction) with a Varimax Rotation was conducted (See Table 1). The assumptions for the analysis were met: Bartlett’s test of sphericity was statistically significant (χ2 45 = 258.06, p < .001) and the KMO measure obtained a decent value (KMO = .72). Based on the scree plot and Kaiser criterion it was decided to retain 3 common factors for embodiment. No factors needed to be removed. The first factor contained four items (Eerie, Weird, Fake, Pleasant) and was interpreted as the uncanny valley effect. The second factor contained three items (Personal, Anthropomorphism and Beauty) and was interpreted as Social Presence. Lastly, the third factor was made up of three items (Social, Friendly, Sympathy) and was interpreted as Likeability.

Table 1

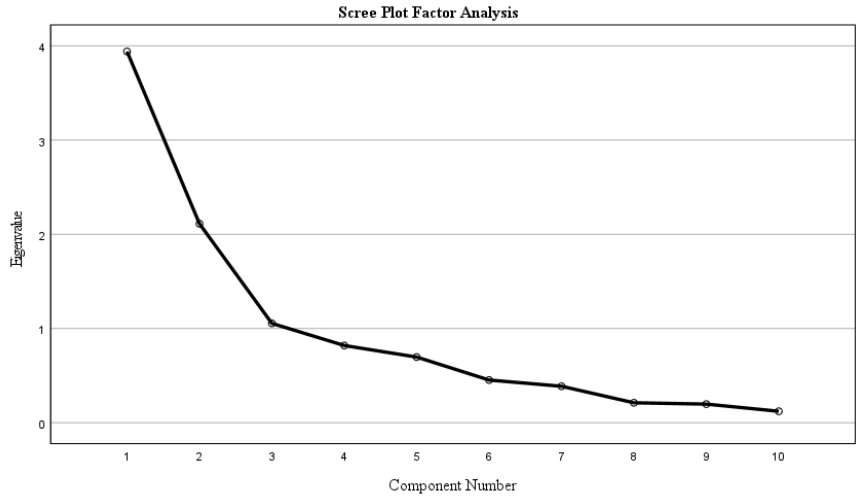
Rotated Component Matrix[a]

	Component		
	1	2	3
Personal	-.094	.682	.459
Social	-.090	.499	.694
Eerie	.926	-.053	.083
Weird	.918	.100	-.003
Anthropomorphism	.129	.820	.229
Fake	.667	.519	.019
Beautiful	.371	.679	-.008
Pleasant	.586	.271	.357
Friendly	.223	.116	.712
Sympathy	.057	.066	.888

Note. Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 5 iterations.

Figure 5

Scree Plot of Factor Analysis



A reliability analysis revealed that the Uncanny Valley factor had a reliability of α = .43. However, the Scale if Item Deleted statistics showed that deleting the item "Pleasant" could elevate the Cronbach's Alpha to α = .86 (M = 4.30, SD = 1.44). Additionally, this item did not significantly improve the Alpha of any other factors. Therefore, this item was removed from the analyses.

Table 2

Means and Cronbach's Alpha of Analysed Constructs

Construct	Mean (SD)	Cronbach's Alpha
Ease of Use	6.05 (1.26)	.88
Usefulness	5.67 (1.29)	.92
Political Knowledge	5.21 (1.12)	.73
Trust	5.32 (1.07)	.59
Likeability	4.93 (1.04)	.70
Uncanny Valley	4.30 (1.44)	.86
Social Presence	3.19 (1.10)	.71

Procedure

Two researchers booked enclosed study rooms on the campus of Tilburg University to conduct the experiment. Multiple laptops were set up in the enclosed room at the same time, while still allowing for a decently silent working environment. One researcher would routinely prepare the laptops for new participants, while the other actively scouted the campus grounds for willing participants. Upon arrival in the room, participants were seated at a laptop with two active internet tabs. The first tab contained an information letter explaining what the study was about and an informed consent form situated in Qualtrics. The letter explained which data was stored, with a specific distinction between whether participants answered substantively (Agree / Disagree) or not (Neither / Skip). This was an important distinction to make, because choosing the latter can express a lack of understanding (Kamoen & Holleman, 2017). Moreover, the letter explained how participants could interact with the chatbot and that those interactions would be saved to aid the development of similar tools in the future. Next, participants were instructed to switch tabs and complete the CAVAA.

The second tab hosted the CAVAA, which was initially protected by a password to keep the data secure. Before every data collection session began, the researchers readied the laptop each time by opening the two tabs and filling in the password. Moreover, each CAVAA session had its own unique code contained in the URL, allowing for its data to be linked to the Qualtrics survey of the same participant. This unique participant code, the

associated condition and the time of collection were both also manually noted down by one researcher per session.

After completing the CAVAA, participants were instructed to return to the first tab and finish filling in the Qualtrics survey. The survey, in order, contained questions about political measures, voting intention, tool evaluations, embodiment measures, expertise[1] and gender. Lastly, participants were shortly interviewed on their opinions on the CAVAA tool. The interviews were conducted outside of the room, as to not bother other participants.

[1] Expertise was measured in the survey because of a collaboration with other similar projects.

Results

In order to analyse the results, multiple ANOVAs and t-tests have been conducted. Firstly, analyses between each of the digital humans and the disembodied CAVAA were made on political measures and tool evaluations to gauge the effectiveness of digital humans as an addition to CAVAAs. Secondly, comparisons were made between the two digital humans to assess whether celebrity status had an influence on embodiment measures. Lastly, a thematic analysis was conducted for qualitative insights into the CAVAA's tool evaluation. See Appendix A for the assumptions of normality and homogeneity. Additionally, some mediation analyses and a thematic analysis were performed.

The survey included a manipulation check to see whether participants actually knew the celebrity digital human beforehand. The data revealed that 46,2% of participants were familiar with the celebrity, while the other 53,8% were unfamiliar with the celebrity. Moreover, the check question revealed that 49 out of 51 participants in digital human conditions correctly identified the name of the agent they interacted with. The remaining two participants, one from each condition, answered incorrectly.

Comparison between the Three CAVAA Conditions

Political Measures

To test hypothesis 1, whether digital humans would score higher on Political Knowledge and Voting Intention than the disembodied CAVAA, one-way ANOVAs were performed. When it came to Political Knowledge, the results were not significant ($F(2, 78) = .28$, $p = .754$, $\eta^2 = 0.01$), meaning no significant differences between the conditions were found. However, the disembodied CAVAA did score the highest, and the celebrity digital human the lowest (See Table 3).

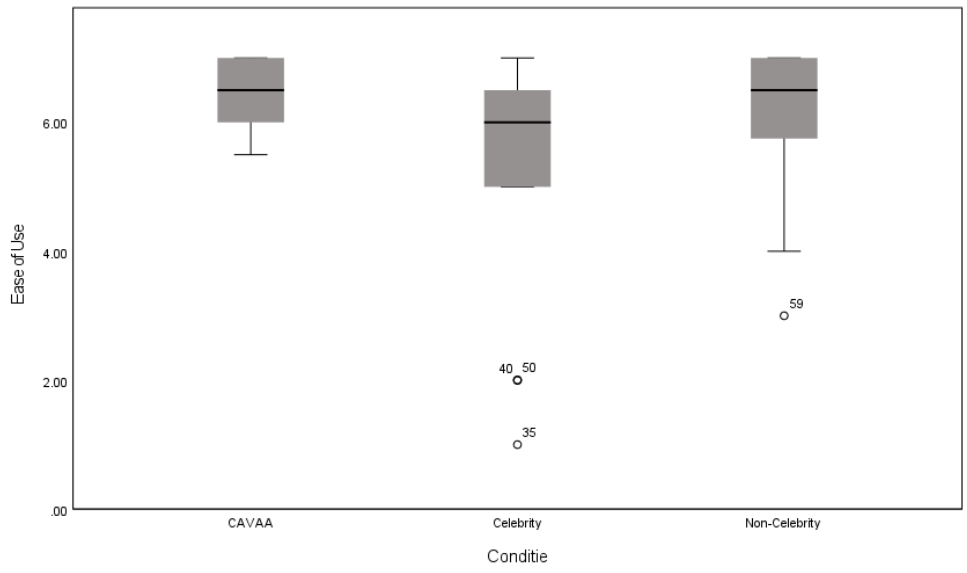
As for voting intention, after interacting with the CAVAA, 72.8% of participants indicated they were going to vote in the upcoming European election, 1.2% indicated they were not going to vote and 24.7% were unsure. Additionally, one participant disclosed that they were not eligible to vote. However, voting intentions were similar between the disembodied CAVAA and the celebrity and non-celebrity digital human. According to the one-way ANOVA, no significant differences in voting intention were found between conditions, $F(2, 77) = .035$, $p = .965$, $\eta^2 = .00$. The results have shown no significant difference in Political Knowledge nor Voting Intention between each of the digital humans and the disembodied CAVAA. Therefore, the expectations of hypothesis 1 have not been met.

Tool Evaluations

To test hypothesis 2, whether the digital human conditions scored higher on Tool Evaluation measures (i.e., Ease of Use and Usefulness) than the disembodied chatbot, multiple one-way ANOVAs were performed. On average, Ease of Use for the disembodied CAVAA was the highest, with the non-celebrity digital human following in second and the celebrity scoring the lowest (See Table 3). The pattern of means is displayed in Figure 6. A significant effect of the digital human conditions on Ease of Use was found, $F(2, 78) = 4.20$, $p = .019$. The post hoc Games-Howell analysis[2] showed a significant difference between the celebrity digital human and the disembodied CAVAA, *Mdiff* = -.93, $p = .036$, BCa 95% CI [.002, .219]. However, there was no significant difference between the disembodied CAVAA and the non-celebrity digital human, *Mdiff* = -.24, $p = .560$, BCa 95% [-.818, .331]. Additionally, between the two digital humans no significant results were found either, *Mdiff* = .69, $p = .215$, BCa 95% CI [-.290, 1.660]. Thus, the disembodied CAVAA was found to be Easier to Use than the celebrity digital human.

Figure 6

Box Plot Ease of Use



As for Usefulness, the non-celebrity digital human had the highest mean, with the celebrity digital human and disembodied CAVAA in second and third respectively (See

[2] For the post hoc analysis, the Games-Howell test was chosen, because the data was not normally distributed and the assumption of homogeneity was violated.

Table 3). However, the ANOVA showed that participants considered these three conditions equally useful since no significant main effect was found, $F(2, 78) = 1.34$, $p = .268$, $\eta^2 = 0.03$.

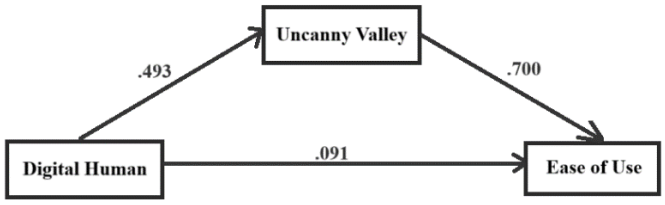
Mediation Analysis

To test the underlying assumption that the uncanny valley would worsen tool evaluations for the digital humans, a mediation analysis was conducted. Solely the variable Ease of Use was analysed, because the other variables did not have significant direct effects and would likely not produce mediation effects either. The mediation analysis was performed via Process V24 and tested the significance of potential mediators as well as their possible direct and indirect effects (Hayes, 2012).

For the mediation analysis, the data was checked to see whether Uncanny Valley mediated the relationship between each type of digital human and Ease of Use (See Figure 8). The direct relationship between digital humans and Ease of Use was not significant ($\beta = -.69$, $p = .091$). Even though the direct relationship was not significant, the Uncanny Valley effect was still considered a potential mediator due to its possible impact on Social Presence. Unfortunately, the digital humans were not significantly different in their Uncanny Valley values ($\beta = .27$, $p = .493$). Additionally, Uncanny Valley did not predict Ease of Use ($\beta = .05$, $p = .700$). The indirect effect of digital humans on Ease of Use was low, Effect = .015, BootSE = .073, Boot Cl[-.116, .192].

Figure 7

Mediation Analysis of Uncanny Valley on Ease of Use



For hypothesis 2, Ease of Use was the only variable that yielded significant results between the CAVAA and digital human conditions. Participants who interacted with the CAVAA reported higher Ease of Use scores than those who interacted with the celebrity digital human. However, the comparison with the non-celebrity digital human did not yield significance and no mediation effects of the Uncanny Valley were found. Thus, hypothesis 2 has only partially been met.

However, of note was that the celebrity digital human consistently scored the lowest on both Tool Evaluations and Political Measures, even though in all but one case no statistically significant differences have been found (See Table 3).

Table 3

Means and Standard Deviations of Tool and Political Measures

Construct	Disembodied CAVAA	Celebrity CAVAA	Non-celebrity CAVAA
Political Knowledge	5.32 (.73)	5.09 (1.37)	5.20 (1.22)
Voting Intention*	1.75 (1.32)	1.72 (1.31)	1.81 (1.33)
Ease of Use	6.19 (1.10)	5.50 (1.74)	6.43 (.54)
Usefulness	5.80 (.99)	5.33 (1.52)	5.85 (1.52)

*Note. *Voting intention of people who were eligible to vote.*

Comparison Between Digital Human Conditions

To test hypothesis 3, the digital human conditions were compared on all the embodiment measures, specifically Uncanny Valley, Social Presence, Likeability and Trust. The celebrity digital human was expected to score lower on Uncanny Valley, and higher on Social Presence, Likeability and Trust compared to the non-celebrity digital human. Separate independent samples t-tests were conducted for each embodiment measure. See Table 4 for an overview of the mean and standard deviation per condition.

Uncanny Valley

To test whether the celebrity digital human scored lower on Uncanny Valley than the non-celebrity, an independent samples t-test was conducted. On average, the mean of Uncanny Valley for the non-celebrity digital human was lower than that of the celebrity. However, according to the t-test, this difference was not significant, $Mdiff = -.28$, $t(51) = -.70$, $p = .493$. This was not in line with hypothesis 3.

Furthermore, to test whether the celebrity digital human would score higher on the positive embodiment measures, another series of independent samples t-tests was performed. The Social Presence mean of the non-celebrity digital human was lower than the mean of the

celebrity. However, this difference was not significant either, *Mdiff* = -.23, *t*(51) = -.78, *p* = .444. Moreover, the data for Likeability revealed that the celebrity CAVAA had the highest Likeability score. However, the independent samples t-test was not significant, *Mdiff* = -.41, *t*(51) = -1.57, *p* = .123. Lastly, as a last tool evaluation and embodiment analysis, the celebrity digital human was compared to the non-celebrity digital human in terms of Trust via an independent samples t-test. Trust was an important facet to measure, since participants needed to be able to trust the political information disclosed by the chatbot in order to accept it. The t-test revealed that, on average, Trust for participants in the non-celebrity condition was higher than for participants in the celebrity condition. However, this difference was not significant, *Mdiff* = .33, *t*(51) = 1.11, *p* = .271. These results were not in accordance with hypothesis 3.

The comparison between the celebrity and non-celebrity digital human showed that the non-celebrity consistently scored lower than the celebrity in terms of Uncanny Valley, Social Presence and Likeability. However, these differences were not statistically significant. Therefore, hypothesis 3 has not been met, indicating no differences were present between the celebrity and non-celebrity digital human in terms of embodiment measures.

Table 4

Means and Standard Deviations of Embodiment Measures

Construct	Celebrity CAVAA	Non-celebrity CAVAA
Uncanny Valley	4.40 (1.34)	4.16 (1.55)
Social Presence	3.31 (.98)	3.07 (1.20)
Likeability	4.81 (.82)	4.40 (1.07)
Trust	5.15 (1.14)	5.48 (1.00)

Thematic Analysis Interviews

When participants finished the survey, some additional interview questions were asked. First, participants from all conditions were asked regarding their general experience with the CAVAA tool. This question was answered 71 times. The lion's share of participants

thought positively of the tool, with 88.7% giving positive feedback and 11.3% being dissatisfied. Words like “convenient” and “nice” were used frequently to describe the CAVAA by satisfied participants, whereas the dissatisfied people mainly indicated they had communication issues with the chatbot. Similarly, the second question asked if the chatbot was a valuable addition to the VAA. This question was answered 59 times, with 84.7% deeming the chatbot valuable and 15.3% not seeing its added value. Many participants mentioned they thought the pre-made question buttons of the chatbot were valuable, such as the button to display pros and cons for a political statement. People who did not evaluate the chatbot as a valuable addition mainly thought the CAVAA was too similar to a normal VAA or experienced miscommunication when posing open questions to the chatbot.

Furthermore, the third question that was posed asked participants for suggestions on how to improve the CAVAA. Among the 43 suggestions, adding more depth to the information the chatbot provided was the most common with 41.9% of them mentioning it. In a similar vein, 34.9% of the suggestions were about improving the responsiveness of the chatbot, in order to avoid miscommunication and allow open questions to shine. Some participants (9%) also mentioned the user interface of the chatbot could use more clarity, by adding elements such as headers and bold text. Moreover, three people provided a concrete suggestion for the digital humans; they should be a cartoonish conversational agent instead, in order to alleviate eeriness. Lastly, two participants had specific suggestions for the political aspects of the VAA. One suggested that the pros and cons should be kept equal in weight, to mitigate possible biases that could steer users in a certain direction. The other suggestion regarded the addition of knowledge about which political parties had a chance to gain seats and which parties would end up in which fractions of the parliament.

Moreover, the last question regarded whether a digital human was (or could be) a valuable addition to the CAVAA. Only 35.5% of participants indicated they would like the chatbot to be a digital human, whereas 64.5% of participants thought a disembodied chatbot would be better. When making a comparison between the digital human versus the disembodied chatbot conditions, the data showed that 55% of the participants in the digital human conditions would prefer the CAVAA to be disembodied. Additionally, the majority of the participants in the disembodied chatbot condition preferred the CAVAA to remain without digital human as well (81.8%). Opponents mentioned the chatbot was either creepy (15) or useless (11), whereas proponents felt like it made the process more personal or human-like (12).

Discussion

The purpose of this study was to ascertain the effects of digital humans on CAVAA tool evaluations, and political and embodiment measures. For this purpose, an experiment with three conditions was performed (disembodied CAVAA vs. celebrity digital human vs. non-celebrity digital human). However, the embodiment measures lacked a third control condition, allowing only for comparisons between the two digital human conditions. Since the demographic of the participants consisted solely of young adult university students, the results are only generalisable within this group. Furthermore, a series of short interviews was conducted to gain qualitative insights into how participants generally experienced the CAVAA and if digital humans were a valuable addition.

Upon comparing the three CAVAA conditions on political measures, no significant differences were found for political knowledge or voting intention. This was not in line with H1, which hypothesized that participants in the digital human conditions would rate their perceived political knowledge and voting intention as higher than those in the disembodied chatbot condition. Contrary to previous political chatbot studies (Kamoen & Liebrecht, 2022; Kim & Lee, 2022; Kim & Lee, 2023), the present study did not find a positive effect of modifications to the CAVAA on the political knowledge and voting intention of the participants. These results seem to suggest that adding digital humans to CAVAAs does not improve the political knowledge nor voting intention of university students. However, at least the digital humans seemed to have no negative effect on voting intention like in the study of Van Zanten and Boumans (2024).

When comparing the three CAVAA versions on tool evaluations, only a difference in their perceived ease of use was found. The disembodied CAVAA was easier to use than the celebrity digital human. In contrast, no difference between the three CAVAA versions was found for usefulness. As seen in CAVAA optimization research by Kamoen et al. (2022) and Liebrecht et al. (2023), structured chatbots (i.e., without text-input fields) were perceived as easier to use. Since the CAVAAs in this study made use of a combination of both text-input fields and structured buttons (as well as the addition of digital humans in two conditions), this may have made these CAVAAs harder to use. Interestingly, the disembodied CAVAA was not perceived as easier to use than the non-celebrity digital human. This contrast with the celebrity digital human that was perceived as harder to use than the disembodied CAVAA could have been caused by an uncanny animation error. Specifically, the celebrity digital human had a lagging animation whenever it blinked, causing it to visually malfunction. Participants could have perceived this malfunction as something that reduced the ease of use

of the CAVAA. Moreover, since usefulness did not differ between the conditions, further evidence has been found for the notion that digital humans do not positively impact the effectiveness of CAVAAs.

Furthermore, the interview revealed that participants generally had a positive perspective on the CAVAAs. The thematic analysis showed that 88.7% gave positive feedback on the tool, with 84.7% of participants considering the chatbot a valuable addition to the VAA. On the other hand, 40% of participants experienced miscommunication with the chatbot when attempting to acquire more in-depth information which it could not provide. This might have hampered improvements to the political knowledge and voting intention of participants. Despite generally positive evaluations of the CAVAA, when specifically asked about the digital humans, 55% of people from the digital human conditions indicated they would have rather interacted with a disembodied CAVAA. Moreover, 88% of participants in the disembodied CAVAA condition preferred the chatbot in its disembodied state and did not see the added benefit of embodiment. Additionally, fifteen people mentioned the digital humans were creepy. These qualitative results seem to suggest that while the CAVAA was seen as beneficial by participants, the addition of digital humans was not the source of this for the majority of them. These results were generally in accordance with H2.

Next, the two types of digital humans were compared with each other individually on the embodiment measures. The comparison did not reveal any significant differences between the celebrity and non-celebrity digital human in terms of eeriness, social presence, likeability and trust. This was not in line with H3, which expected that people in the celebrity digital human condition would experience significantly less uncanny valley-related feelings and more social presence and likeability than those in the non-celebrity condition. In general, these findings would be contradictory to the source attractiveness model. This model proposes that the attractiveness that celebrities have is transferred to the product they are endorsing (McCracken, 1989; Mowen et al., 1979). In this case, the presumed attractiveness of the celebrity did not change how people evaluated the digital human nor the CAVAA. Moreover, these results are inconsistent with the results of a similar study by Song and Shin (2022), in which the celebrity received lower ratings of eeriness. This difference in results could be explained by the fact that the chosen celebrity in this study was known to only 46,2% of participants. This meant close to half of the participants were not familiar with the celebrity and subsequently might have felt too differently compared to the other half, leading to insignificance. Familiarity (e.g., with celebrities) was found to have a mitigating effect on the uncanny valley according to the proposal of Mori and his colleagues (2012) that

familiarity reduces eeriness. Future research could take the discrepancy in how familiar people are with the celebrity into account as a further analysis. Additionally, a more universally known celebrity should be utilised to avoid such discrepancies.

Another reason for the lack of differences between the celebrity and non-celebrity could lie in the fact that the sports presenter celebrity was not deemed congruent enough with the political CAVAA tool. As a result, the celebrity digital human could have been unable to reap the benefits of the celebrity match-up and meaning transfer models (Lafferty, 2009; McCracken, 1989; Mowen et al., 1979). While congruency can lead to positive outcomes (Mowen et al., 1979), incongruency can lead to negative evaluations (Korchia et al., 2012; Lafferty, 2009). Incongruency could have cancelled out any possible positive influences of the celebrity on the CAVAA.

Limitations and Suggestions for Further Research

First and foremost, a limitation of the current study is that not all dependent variables were measured for the disembodied CAVAA control condition. As a result, no three-way comparisons could be made between the digital humans and the disembodied chatbot on the embodiment measures. Without these data, the base assumption of the study (i.e., that digital humans negatively impact the CAVAA experience due to the uncanny valley) was not entirely ascertainable. Naturally, this should be included in a follow-up study to further test this assumption. However, one could wonder whether a difference between the conditions will be found since most of the tool evaluation differences in the current study did not bear any significance.

Moreover, the quality of the visuals and animations of the digital humans were suboptimal due to animation errors. Specifically, the celebrity digital human lagged with its animation whenever it blinked, causing it to malfunction visually. Additionally, the short animation loops could have been smoother, as these stuttered whenever they refreshed. These limitations could have influenced the results, especially for the celebrity digital human. As discussed earlier in the theoretical framework, non-verbal behaviour is a crucial aspect of digital humans (Koda & Maes, 1996; Tastemirova et al., 2022; Thepsoonthorn et al., 2021). Facial expressions in digital humans can generally lead to an improvement in engagement and social presence (Koda & Maes, 1996). Imperfect non-verbal motions can exacerbate the uncanny valley effect and, in turn, influence the appeal and familiarity of the avatars (McDonnell et al., 2012). Thus, the imperfect blinking animation of the celebrity digital human could have led to non-significant results for likeability and social presence.

Perhaps more significant results in the realm of embodiment measures would have presented themselves if the visual fidelity was more accurate. For instance, research comparing more visually advanced "meta-humans" to digital humans showed that digital humans were rated worse on social presence and human-likeness (Bae et al., 2024). Besides employing meta-humans, researchers should consciously design to avoid the uncanny valley, rather than seeking how to improve an avatar's positive perceptions (Kim et al., 2022). For instance, the skin colour of the avatars should not be too bleak, as it could subconsciously remind people of death and trigger the effect (Mori et al., 2012).

Another angle for future research is to replicate this study with a different demographic. Currently, solely university students were used. As previous research by Kamoen and Liebrecht (2022) described, people with a higher education level are associated with having higher political sophistication. Political sophistication is a concept pertaining to an individual's cognitive ability to comprehend new information, their current amount of knowledge and their motivation to work to obtain more information (Luskin, 1990). However, people with low levels of political sophistication could have a more difficult time comprehending VAA statements and thus require extra information. As a result, the information the CAVAA provides can be more valuable to them (Kamoen & Holleman, 2017). Therefore, analysing different demographics (e.g., secondary vocational education students with generally lower levels of political sophistication) might yield different results in terms of tool evaluations and political measures.

Theoretical and Practical Implications

Digital humans and their possible uncanny valley influences have not been studied in a CAVAA-context before, so the results of the present study can function as a stepping stone for further research. The results seem to suggest that digital humans have little impact on the CAVAA process. The only negative effect that was observed was that the VAA with celebrity chatbot was experienced as more effortful to use by participants. However, this might have been caused by an animation error. Furthermore, uncanny valley-related feelings were tested but not found as mediators of ease of use. Therefore, this study has shown that the addition of digital humans does not improve CAVAA experience and should therefore not be used to motivate students to vote.

This study assumed that the heightened anthropomorphic and social presence qualities of digital humans could lead to more engagement (e.g., Moriuchi, 2020; Tsai et al., 2021). Extra engagement with the CAVAA was subsequently assumed to lead to higher political

measures. However, this relationship might not exist for digital humans in CAVAA contexts as suggested by the lack of significant results. This could have been caused by the chatbot not being advanced enough yet to answer in-depth questions, as revealed by the interview. On that account, future studies could research whether more engagement with CAVAAs is mediated by the anthropomorphism and social presence of the conversational agent and if this directly related to improved political measures.

Furthermore, one could wonder whether the original uncanny valley effect, which originated in the field of robotics (Mori, 1970), is also fully applicable to digital humans that function as conversational agents. One branch of research into the uncanny valley effect with digital humans has generally put emphasis on participants evaluating human-like avatars, without thoroughly interacting with them (Bouwer & Human, 2017; Tastemirova et al., 2022). However, digital humans that also function as conversational agents can benefit from increased levels of social presence as this adds a layer of behavioural realism (Fitton et al., 2020; Kim et al., 2020; Ruiz-Equihua et al., 2022). Subsequently, this type of digital human might only evoke a lesser uncanny valley effect. Current research findings on the uncanny valley effect during interactions with conversational agents are still divisive. While some research has found that the human-likeness of the conversational agent evoked negative uncanny valley-related emotions within participants (Ciechanowski et al., 2019; Thaler et al., 2020), other studies have found no or lesser negative effects (Bae et al., 2024; Kätsyri et al., 2019; Seymour et al., 2021; Skjuve et al., 2019). With few effects found, this study functions as further evidence for digital humans only prompting a lesser uncanny valley effect compared to robots (Kätsyri et al., 2019).

As for the use of celebrity likeness, the results of this study were not in accordance with the notion that celebrity familiarity decreases uncanny valley effects (Destephe et al., 2015; Mori, 1970; Song & Shin, 2022). This could suggest that celebrity avatars require more careful avatar design than non-celebrity avatars. Animation errors and other visual or behavioural inconsistencies might significantly hinder the positive influence of familiarity (McDonnell et al., 2012). Moreover, a recent study (Jung et al., 2022) has touched on the fact that virtual celebrity avatars require more design efforts to avoid uncanny valley effects, as people are quicker to recognise their facial differences. In turn, this mismatch between expectations and reality can feel jarring for people. Therefore, celebrity digital humans must be implemented carefully in order to avoid them falling into the uncanny valley.

In the current state of the art, digital humans are a more expensive addition to VAAs that will probably not pay off or improve their performance. Hence, for practical use, when

political organisations want to employ CAVAAs, they should opt for versions without digital human until further research is conducted.

Conclusion

The present study found that people evaluated the disembodied CAVAA as easier to use than the CAVAA with the celebrity digital human. No other effects regarding tool evaluations, political and embodiment measures were found. Moreover, no celebrity effects were observed. For better or for worse, digital humans generally seemed to have no significant impact on the effectiveness of the CAVAA. Therefore, digital human usage for CAVAA might be ineffective at increasing political knowledge and voting intention among young adults. Future CAVAA optimalisation research should focus on analysing more advanced virtual avatars, as these are less prone to the uncanny valley.

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Appendix

Appendix A

This Appendix regards the assumptions of normality and homogeneity for each of the analyses performed in the Results section.

Normality and Homogeneity of the Items

Ease of Use

The data was not normally distributed for Ease of Use (z-score skewness = -2.26, z-score kurtosis = 5.44). The assumption of normality was violated. A bootstrap was not performed since one-way ANOVAs are decently robust against this violation, but the results should be interpreted with caution.

Usefulness

The data was not normally distributed for Usefulness (z-score skewness = -1.64, z-score kurtosis = 2.818). The assumption of normality was violated. Equal variance between groups was assumed, $F(2, 78) = 1.674$, $p = .194$, so the assumption homogeneity of variance was met.

Political Knowledge

The data was normally distributed for Political Knowledge (z-score skewness = -1.09, z-score kurtosis = .989). The assumption of normality was met. Equal variance between groups was not assumed, $F(2, 78) = 3.94$, $p = .023$. For this reason, the Welch statistic had to be taken into account. The Welch test was not significant $F(2, 46.89) = .33$, $p = .721$, so follow-up tests were not performable.

Trust

The data for Trust was normally distributed (z-score skewness -.697, z-score kurtosis .554), so the assumption of normality was met. Equal variance between groups was assumed, $F(1, 51) = .86$, $p = .358$, so the assumption homogeneity of variance was met.

Uncanny Valley

The factor uncanny valley was normally distributed (z-score skewness -.354, z-score kurtosis -.982). The assumption of normality was met. According to Levene's Test, equal variances between groups was assumed, $F(1, 51) = 1.62$, $p = .209$. Therefore, the assumption of homogeneity was met.

Social Presence

Furthermore, the factor Social Presence was normally distributed (z-score skewness .290, z-score kurtosis -.587), so the assumption of normality was met. Equal

variances between groups was assumed, $F(1, 51) = 1.74$, $p = .193$. The assumption of normality was met.

Likeability

Data for Likeability was normally distributed (z-score skewness = .056, z-score kurtosis = -.991). Therefore, the assumption of normality was met. Equal variances were also assumed according to Levene's Statistic, $F(1, 51) = 2.03$, $p = .161$. Thus, the assumption of homogeneity was met.