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Follow Me If You Want to Live - Understanding the Influence of Human-Like Design on Users' Perception and Intention to Comply with COVID-19 Education Chatbots

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Completed Research Paper

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Abstract

Following recommendations and complying with behavioral attitudes is one major key in overcoming global pandemics, such as COVID-19. As the World Health Organization (WHO) highlights, there is an increased need to follow hygiene standards to prevent infections and in reducing the risk of infections transmissions (World-Health-Organization, 2021). This urgent need offers new use cases of digital services, such as conversational agents that educate and inform individuals about relevant counter measurements. Specifically, due to the increased fatigue in the population in the context of COVID-19, (Franzen and Wöhner, 2021), CAs can play a vital role in supporting and attaining user's behavior. We conducted an experiment (n=116) to analyze the effect of a human-like-design CA on the intention to comply. Our results show a significant impact of a human-like design on the perception of humanness, source credibility, and trust, which are all (directly or indirectly) drivers of the intention to comply.

Keywords: Digital Health, COVID-19, Conversational Agent, Human-like-design, Intention to comply

Introduction

Due to the COVID-19 pandemic, the World Health Organization (WHO) and countries around the world provided recommendations and implemented measures to contain outbreaks (European-Centre-for-Disease-Prevention-and-Control 2020). One central component of these recommendations is increased hygiene, such as very frequent handwashing (Venkatesh and Edirappuli 2020) and social distancing (Shearston et al. 2021). To comply with social distancing rules, individuals had to be counseled and educated at home regarding various relevant topics, such as self-testing and hygiene measures (Amato et al. 2017; Barakat and Kasemy 2020; European-Centre-for-Disease-Prevention-and-Control 2020). Different means of communication were used to reach and inform all citizens, including traditional approaches, such as TV spots and flyers (Michigan-Government 2021), and new digital approaches, including Conversational Agents (CAs) (Miner et al. 2020).

CAs are "software-based systems designed to interact with humans using natural language" (Feine et al. 2019, p.1). The benefits of CAs are the ease of use and comfort of interacting via natural language instead of potential complex and confusing graphical interfaces (Ahmad et al. 2018). CAs can be differentiated into voice or text-based systems, whereas text-based CAs are often referred to as chatbots (Diederich et al. 2022). One prominent example is the chatbot of the WHO, accessible via WhatsApp. It was launched in March 2020 and provides users with important information on how to prevent a COVID-19 infection (World-Health-Organization 2021).

CAs have the potential to alter users' affection, cognition, and behavior (Diederich et al. 2022). Social cues (e.g., having an avatar, greeting users, and utilizing emoticons) can be implemented to induce a sense of humanness and social presence in users (Gefen and Straub 2004). This effect causes users to see a CA as a social actor, similar to a human (Nass et al. 1994). As a result, a human-like designed CA can induce a sense of trustworthiness (de Visser et al. 2016), enjoyment (Lee and Choi 2017) and persuasiveness (Diederich et al. 2019). Besides increasing a CAs' technical skills (i.e., improving algorithms for processing natural language), researching the impact and effect on users of human-like design elements remains a key topic of interest for theory and practice (Diederich et al. 2022; Feine et al. 2019).

The increasing importance of building effective CAs for health counseling and prevention (e.g., COVID-19), such as advising about hygiene measures (Miner et al. 2020), has led to a number of recent studies on this topic (Abd-Alrazaq et al. 2020; Almalki 2021; El Hefny et al. 2021; Jordan et al. 2021). One prominent topic is to investigate how CAs should be designed to improve users' intention to comply. In this context, several factors have been found to play an important role, such as accuracy (Espinoza et al. 2020), trust, and situational factors (e.g., the severity of symptoms) (Dennis et al. 2020). However, understanding the effect of CA's human-like design on users' intention to comply with COVID-19 related hygiene measures has yet to be engaged in research. To our best knowledge, this has not been investigated so far. Against this background, this study aims to answer the following research question:

RQ: How d*oes CA's human-like design influence a user's intention to comply with health-related recommendations?*

To address this research question, we conducted an online experiment with 116 users to investigate the relationship of a human-like design CA (e.g., human-like versus non-human-like) on the perception of humanness, persuasiveness, source credibility, trust and the intention to comply. Our results provide support for a positive impact on the intention to comply of a human-like design CA. However, we reveal that trust is mediated by persuasion, which in turn positively influences the intention to comply.

Research Background

Conversational Agents for Healthcare Services and COVID-19

In healthcare contexts, ELIZA was one of the first CAs and it was built to emulate a therapist (Weizenbaum 1966). Since then, CAs have been applied to numerous healthcare-related areas, including mental health (Park et al. 2021), medication adherence (Fadhil 2018), psychiatric counseling (Oh et al. 2017) and health nutrition (Casas et al. 2018). Specifcally in healthcare, CAs go beyond existing static information forms and provide a convient customer and patient experience (Laranjo et al. 2018). Compared to human service encounters, CAs are not limited by time and place, which is an advantages for providers and users (Gnewuch

et al. 2018; Verhagen et al. 2014). Regarding COVID-19, CAs have been applied for various services, ranging from personal risk assessments, acquiring general information about preventing an infection, to combating fake news, and misinformation (Judson et al. 2020). For example, the chatbot Clara was introduced by the Centers for Disease Control and Prevention as a public self-checking tool, asking various questions about the individual vaccination status and health symptoms, and subsequently providing recommendations (e.g., staying at home and take a test)(CDC 2020).

However, for these CAs to lead to significant effects, users and patients must comply with the recommendations and advices (Dennis et al. 2020). To the best of our knowledge, a unified definition of compliance is in medicine and psychology contexts still missing and many synonyms are used, such as adherence, therapeutic alliance or cooperation (Kyngäs et al. 2000). In this study, we understand intention to comply as a patient's willingness to follow healthcare experts' prescriptions (e.g., treatment programs) (Murphy and Coster 1997). The patient's willingness to act complaint, depends on numerous relational (i.e., trust) and situational factors (i.e., style of information presentation) (Hojat et al. 2010; Segal 1994). Adapted to the context of hygiene and COVID-19 CAs, users act compliant with the suggestions of the CA when they act as recommended (e.g., wash hands more frequently). In this context, the user's intention to comply can be expected to depend on how the CA and its recommendations are perceived (Dennis et al. 2020; Liu and Sundar 2018). For example, even when a CA provides perfect recommendations, it still has to be perceived as trustworthy for users to comply (Dennis et al. 2020).

### *Human-Like Designed Conversational Agents*

The tendency of associating human-like characteristics to objects is anchored in the human subconscious mind and called anthropomorphism (Howard and Kunda 2000). This bias causes humans to associate objects (e.g., pet rocks), cartoon characteristics (e.g., Goofy) and animals (e.g., smiling monkeys) with human characteristics (Epley et al. 2007). Anthropomorphism also applies to the context of users communicating with CAs (e.g., by using Siri or Alexa). The phenomenon is further explained by the "Computers are Social Actors" (CASA) paradigm (Nass et al. 1994) and the Social Response Theory (Nass and Moon 2000).

The CASA paradigm states, that computers are attributed by their users with a certain level of humanness, despite knowing it is a machine (Nass and Moon 2000). The level of perceived humanness is influenced by the extent of human-like design features – i.e., quantity and type of social cues. Based on the perceived level of humanness, users apply social norms to CAs (e.g., gender stereotypes) (Lang et al. 2013; Nass et al. 1994; Nass and Moon 2000). Furthermore, the Social Response Theory states that users are triggered by social cues to act similar to a human-to-human encounter (e.g., saying thank you at the end of a conversation; Feine et al. 2019; Nass and Moon 2000). In this context, recent studies reported various cognitive and behavioral effects when CAs are equipped with social cues, such as increased enjoyment (Lee and Choi 2017), persuasiveness (Diederich et al. 2019), and perceived trust (Araujo 2018).

To structure social cues for CAs, Seeger et al. (2018) presented three main types: human identity, verbal cues, and non-verbal cues. Examples for human identity cues are a name (Cowell and Stanney 2005) or gender (Nunamaker et al. 2011). Verbal cues include turn-taking (Gong 2008), word and syntax variability (Seeger et al. 2018) and self-reference (Schuetzler et al. 2018). Non-verbal cues include the use of emoticons (Feine et al. 2019) and dynamic response delays (Gnewuch et al. 2018).

Research Model and Hypotheses

Our study aims to investigate the role of human-like CA design and the resulting perception of humanness in context of users' intention to comply with hygiene recommendations. Building upon the social response theory (Nass and Moon 2000) and CASA (Nass et al. 1994), we develop a set of hypothesis on how perceived humanness influences source credibility, trust, persuasiveness, and users' intention to comply, including the relationships among these constructs (see Figure 1). In the following sections, we will present and explain our set of hypotheses in more detail.
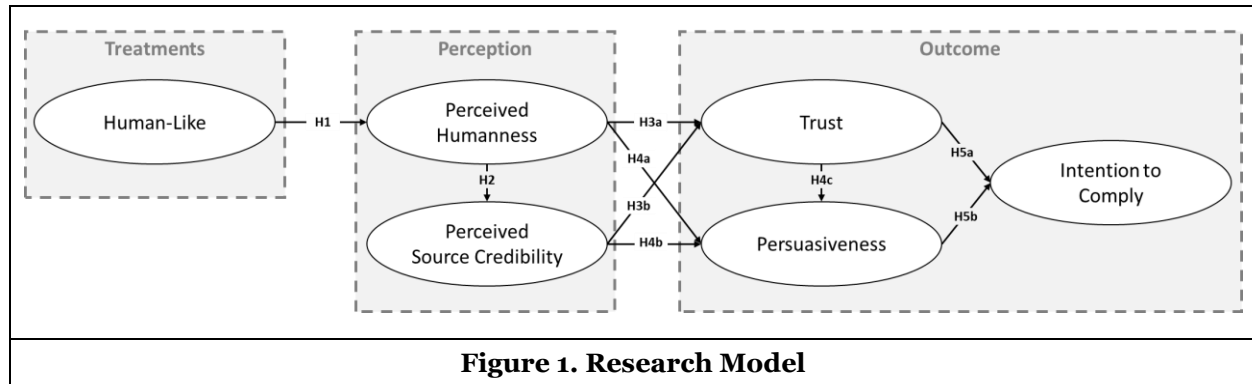
Figure 1. Research Model

Perceived Humanness

A human-like designed CA means that it is equipped with social cues (Feine et al. 2019; Seeger et al. 2018). Social cues can be the display of an avatar, a name (Cowell and Stanney 2005; Gong 2008; Nunamaker et al. 2011), self-reference, self-disclosure, greeting (Cafaro et al. 2016; Schuetzler et al. 2018), and dynamic response delays (Gnewuch et al. 2018). These social cues trigger anthropomorphism in users (Dacey 2017), i.e., users perceive the CA as human like (Epley et al. 2007). Generally, users are aware that CAs are machines, but this does not prevent the perception of humanness (Nass and Moon 2000).

For instance, a recent study of Westerman et al. (2019) showed that grammar and typing errors influence perceived humanness. Similarly, de Kleijn et al. (2019) studied how unique language characteristics effect perceived humanness and found significance for right-branching sentences (i.e., sentences in which the main topic is stated before further details). Additionally, Go and Sundar (2019) found that a CA with a human-like avatar was associated with higher levels of perceived humanness. We therefore hypothesize:

H1: A human-like CA design increases the perceived humanness of the CA.

Source Credibility

Perceived source credibility can be understood as the judgment made by the message receiver about the communicator's believability (Gilly et al. 1998). In this regard, humans tend to add subjective factors to their judgement process – i.e., source credibility is not an objective measure but is influenced by situational and relational factors (Kumkale et al. 2010), such as initial thoughts on overall impressions (Fogg 2002; Lowry et al. 2008). In CA contexts, Beldad et al. (2016) reported that embodied virtual agents elevate perceived source credibility, leading to a higher purchase intention. These results are supported by the study of Tan and Liew (2020), showing that social cues in mobile commerce chatbots can increase perceived credibility. Thus:

H2: Perceived humanness increases the perceived source credibility.

Trust

To trust means to belief that another entity (either human or artificial) will help in reaching one's goals, despite vulnerability or uncertainty (Lee and See 2004). In the healthcare context, vulnerability refers to a condition associated with patients or humans potentially suffering from an illness (Gjengedal et al. 2013). and uncertainty is the incapacity to interpret or predict illness-related occurrences (Mishel 1981). In context of a COVID-19 CA, trusting a CA means that users belief that it will provide accurate and helpful services, despite the dangers of COVID-19. Because humans are social animals, they are inclined to build trust in social interactions (Yamagishi and Yamagishi 1994). Hence, the perception of humanness in a CA can be expected to increase trust.

The findings of Toader et al. (2020) support this assumptions by demonstrating that users have a higher level of trust for a human-like design chatbot. Similarly, Følstad et al. (2018) reported that human-like features may induce higher levels of trust. Further, the results of Lankton et al. (2015) support a link

between human-like technology design and a user's trust in a system. Thus, we state the following hypothesis:

H3a: *Perceived humanness increases perceived trust.*

Furthermore, the perception of the source of information significantly influence's trust, based on the attractiveness of the source (Hovland et al. 1953; Wiener and Mowen 1986). When interacting with digital recommender systems, users are exposed to a trust transference process – i.e., relying on cues linked to trusted 'proof sources' (Bo and Benbasat 2007; Doney and Cannon 1997). In CA contexts, Yen and Chiang (2021) have reported that credibility has a positive effect on trust if users perceive the source and information as believable. Further, when individuals evaluate the reliability and quality of communication, source credibility has been identified as one of the most important factors impacting trust (Edwards et al. 2016). We therefore derive the following hypothesis:

H3b: *Perceived source credibility increases perceived trust.*

Persuasiveness

In context of CAs, persuasion is succeeding in changing a user's attitude toward a desired stance during the interaction (Lehto et al. 2012) (e.g., taking the dangers of COVID-19 seriously). In this context, research of Cui et al. (2020) have shown that verbal social cues have a high positive impact on persuasion. Similarly, Paskojevic (2014) showed that when users perceive the content on websites as socially present, a website's persuasiveness increases. Regarding CA literature and human-machine-interactions, Diederich et al. (2019) reported that perceived humanness increases persuasiveness. Against this background, we hypothesize:

H4a: *Perceived humanness increases perceived persuasiveness.*

Following Lehto et al. (2012), credibility is one of the main drivers of persuasiveness. In this regard, the study of Pornpitakpan (2004) reported that high credible sources result in higher perceived persuasiveness. Similarly, von Hohenberg and Guess (2022) reported that perceived source credibility drives persuasiveness of partisan topics in media related contexts. Thus:

H4b: *Perceived source credibility increases perceived persuasiveness.*

Furthermore, it has been reported that persuasiveness is influenced by trust due to its effect on the decision-making process (Milliman and Fugate 1988). Beyond human-to human interactions, Dehnert and Mongeau (2022) provide similar findings in human-AI interactions. Hence, trust can be seen as a parameter that significantly influences the user's persuasiveness. In CA research, Hildebrand and Bergner (2019) reported that higher levels of trust are impacting the persuasion process by enforcing a stronger and intimate consumer-brand relationship in human-machine-interactions. Furthermore, current literature state that relational agents are more liked and trusted that in turn lead to a higher perception of behavioral change of users (Sillice et al. 2018). Therefore, we hypothesize:

H4c: *Perceived trust increases perceived persuasiveness.*

Intention to Comply

In the context of CAs, users' intention to comply with recommendations of the CA can be understood as their willingness and ability to follow these recommendations (Dennis et al. 2020; Murphy and Coster 1997) and is a necessary condition for actual compliant behavior (Guhr et al. 2019). In human-machine-interaction, trust is a key driver of intention to comply, because it facilitates cooperative behavior (Kulms and Kopp 2018). For example, patient's trust in physicians can have a favorable impact on the patient's willingness to comply (Lowry et al. 2014; Lu and Zhang 2019). Similarly, trust has been shown to drive intention to comply with CAs' COVID-19-related recommendations (Bulgurcu et al. 2010; Dennis et al. 2020). Thus, we derive the following hypothesis:

H5a: *Perceived trust increases users' intention to comply.*

Persuasion can influence users' intentions to comply because persuasion is the change of one's beliefs and attitudes (Miller 1965; Petty and Briñol 2010), which are the triggers behind intention and subsequent behavior (Feldman and Lynch 1988). Therefore, when a CAs succeeds in persuasions regarding COVID-19

related hygiene measures (i.e., users take hygiene more seriously), the subsequent intention to behave accordingly is also increased. In CA literature it is also reported that perceived persuasiveness significantly impacts user's intention to comply (Drozd et al. 2012). Similarly, current literature about COVID-19 CAs show that users comply when higher levels of anthropomorphism are applied (Kim and Ryoo 2022). Against this background, we hypothesize:

H5b: P*erceived persuasiveness increases users' intention to comply.*

Method

We conducted a between-subject online experiment in the context of CAs for education of COVID-19-realted hygiene measures, including recommendations for future hygiene behavior. Via the experiment, we investigate the influence of a human-like design CA on perceived humanness, source credibility, persuasion, trust, and intention to comply. The experiment was conducted in April of 2022. In the following sections, we will present our sample, task and procedure, treatment designs, and measures.

Participants

We recruited participants via the crowd working platform Clickworker. In total, 118 native German-speakers participated in our experiment. We applied two attention checks and two responses were invalid, resulting in a sample size of 116. The mean age of all participants was 41,5 years and 41,4% were female. Overall, completing the experiment and filling out the survey took in the median under 13 minutes. All participants were reimbursed with 1,30€ for their participation.

Task and Procedure

Following the example of previous studies with CAs (e.g. Bührke et al. 2021; Diederich et al. 2020; Gnewuch et al. 2018), we implemented a structured dialogue with concrete tasks. We specifically selected hygiene as the topic of the interaction because the experiment was conducted around two years after the outbreak of the COVID-19 pandemic. Subsequently, many people have started to fatigue and, thereby, reduce their efforts (e.g., wash hands less frequently) (Franzen and Wöhner 2021; MacIntyre et al. 2021). Subsequently, the interaction with the CA is relevant and timely, and can lead to actual compliance and intention to comply in users.

Treatments

We applied a between-subject design with the comparison of human-like and non-human-like CA design. Users were randomly assigned to one of the two chatbots, to avoid carryover effects (Boudreau et al. 2001). The CAs were implemented via Google Dialogflow and trained with identical language phrases and similar dialogue contexts. Both chatbots were able to understand and process various user inputs (i.e., synonyms or different phrasings with the same intention). The only difference of both chatbots is their appearance; one being equipped with additional social cues (see Figure 2).

The human-like design cues were based on the structural taxonomy introduced by Feine et al. (2019), following visual, verbal and invisible cues. We decided to implement a drawn human-like avatar, name (Emma) and an associated gender (female). Furthermore, it uses emoticons, self-reference ("Hi, I am Emma…") and direct addressing ("do you think that…"). Further, we applied variability in the syntax and the chatbot started the dialogue by greeting the users. Additionally, we implemented a delay of the chatbot responses (e.g., know from instant message services like WhatsApp).

Figure 2. CA with Human-like Design (left) and without Human-like Design (right)
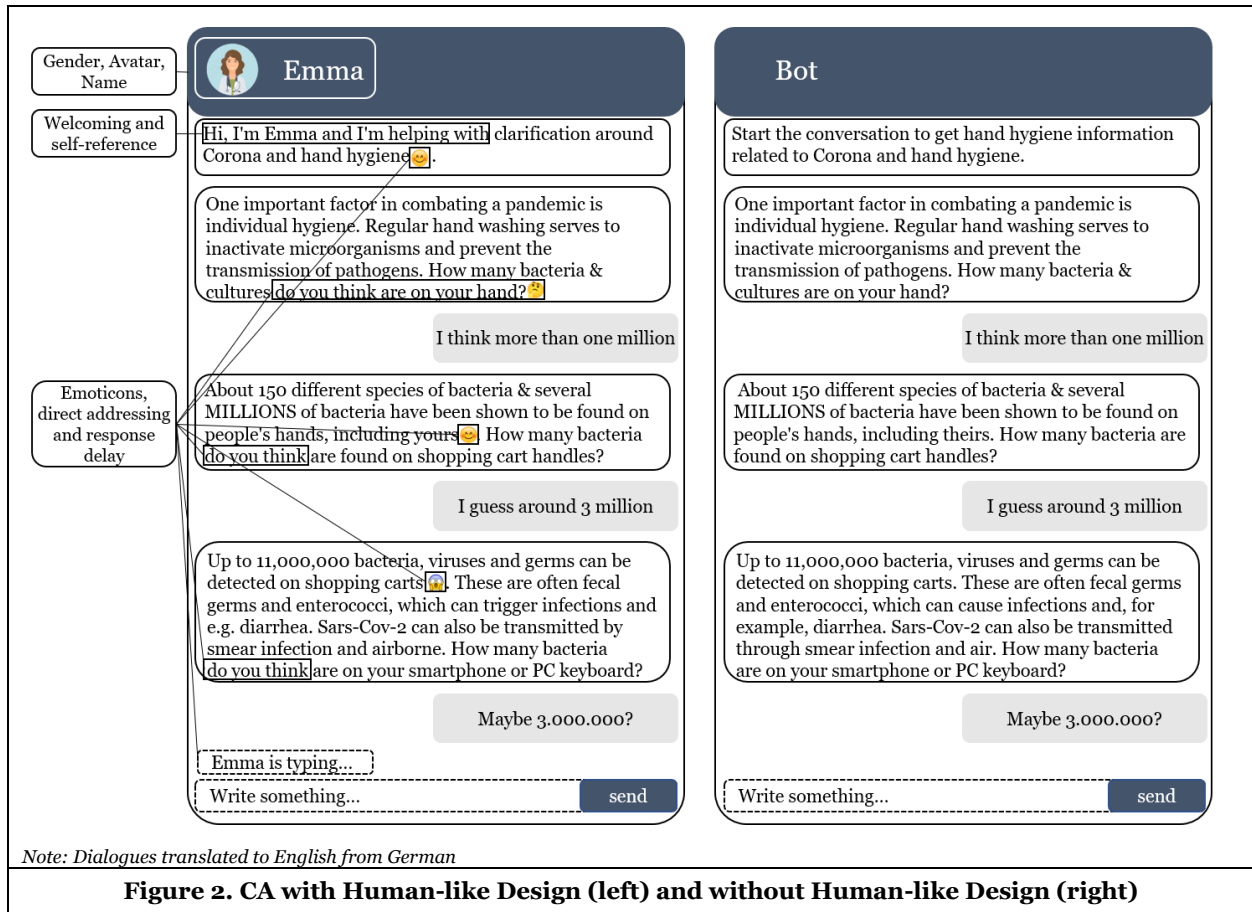
Measures

For our research model, we included constructs and related items from established literature. We measured perceived humanness (Holtgraves et al. 2007) and source credibility (McComas and Trumbo 2001) on a 9-point semantic differential scale. Trust (Yoo and Gretzel 2008), persuasiveness (Lehto et al. 2012), and intention to comply (Bulgurcu et al. 2010) were measured on a 7-pont Likert scale, ranging from 1 ("fully disagree") to 7 ("strongly agree").

All constructs provide a sufficient CR (> .70), a sufficient Cronbach's α value of >.70 and an AVE (> .50) (Cortina 1993; Nunally 1970). As suggested by Gefen and Straub (2005), only factor loadings above .60 were considered. Thus, we removed one item of perceived humanness. A comprehensive overview of the respective constructs and items with their corresponding mean, standard deviation (SD) and factor loading, including Cronbach's α, composite reliability (CR), and average variance extracted (AVE) are visualized in Table 1.

Constructs and Items	Mean	SD	Loadings
Perceived Humanness (Cronbach's α = .821, CR = .874, AVE = .585) (Holtgraves et al. 2007)			
The chatbot is...			
extremely inhuman-like - extremely human-like	4.034	1.480	.680
extremely unskilled – extremely skilled	4.914	1.418	.804
extremely unthoughtful – extremely thoughtful	4.526	1.190	.819
extremely impolite – extremely polite	5.017	1.364	.744
~~extremely unresponsive – extremely responsive~~	~~4.466~~	~~1.585~~	~~.111~~
extremely unengaging – extremely engaging	4.707	1.292	.842
Trust (Cronbach's α = .846, CR = .898, AVE = .691) (adapted from Hyan Yoo and Gretzel 2008)			
The chatbot is reliable.	4.750	1.532	.881
The chatbot is consistent in the recommendations they provide.	5.293	1.358	.816
The chatbot does not make mistakes.	3.871	1.618	.688
The chatbot is dependable.	4.655	1.539	.920
Persuasiveness (Cronbach's α = .876, CR = .923, AVE = .801) (Lehto et al. 2012)			
The chatbot has an influence on my thinking regarding hygiene.	3.345	1.804	.887
The chatbot is personally relevant for me.	3.181	1.811	.916
The chatbot makes me reconsider my thinking about hygiene.	3.267	1.805	.851
Intention to comply (Cronbach's α = .951, CR = .976, AVE = .953) (adapted from Bulgurcu et al. 2010)			
I will follow the chatbots' hygiene suggestions.	4.491	1.825	.977
I will comply with the hygiene recommendations of the chatbot.	4.371	1.949	.975
Perceived Source Credibility (Cronbach's α = .861, CR = .898, AVE = .691) (adapted from McComas and Trumbo 2001)(Kim et al. 2009)			
The chatbot is...			
Inaccurate - Accurate	4.897	1.517	.876
Unfair - Fair	4.810	1.631	.893
Biased - Unbiased	4.509	1.863	.916
CR = Composite Reliability, AVE = Average Variance Extracted, SD= Standard Deviation			
Note all items were translated to German for the survey.			

Table 1. Measurement of Constructs and Items

Further, our results show a sufficient convergent validity and discriminant validity (see Table 2). Due to an AVE >.50, convergent validity is given for all constructs (Hair et al. 2010). Ultimately, our square roots of the AVE (see Table 2, bold numbers) are higher than the correlations between the constructs (Fornell and Larcker 1981). To summarize, our research model indicates sufficient validity and reliability.

Constructs	1	2	3	4	5	6
1. Human-like Design	n.a.					
2. Humanness	.238	**.765**				
3. Intention to Comply	.090	.358	**.976**			
4. Persuasiveness	.008	.447	.723	**.895**		
5. Source Credibility	.060	.575	.319	.449	**.885**	
6. Trust	.078	.631	.345	.479	.510	**.831**
n.a. = not applicable						

Table 2. Inter-Construct Correlations and Validities

Results

We applied the PLS method using Smart PLS 3.3.9 to test our derived hypotheses regarding the relations of a human-like design CA, perceived humanness, perceived source credibility, trust, persuasiveness, and intention to comply. In our analysis, we used the bootstrapping re-sampling method with 5,000 samples to assess the significance paths, as suggested by Chin (1998). For this study, we followed the structural equitation model approach from Bagozzi and Yi (1988) due to the consideration of measurement errors and its multidimensional structure of theoretical constructs. Because of its advantages in terms of limiting assumptions, the partial least squares estimator is commonly utilized in experimental research (Fombelle et al. 2016). Our results with respective coefficients, R^2 values, and significance levels are visualized in Figure 3.
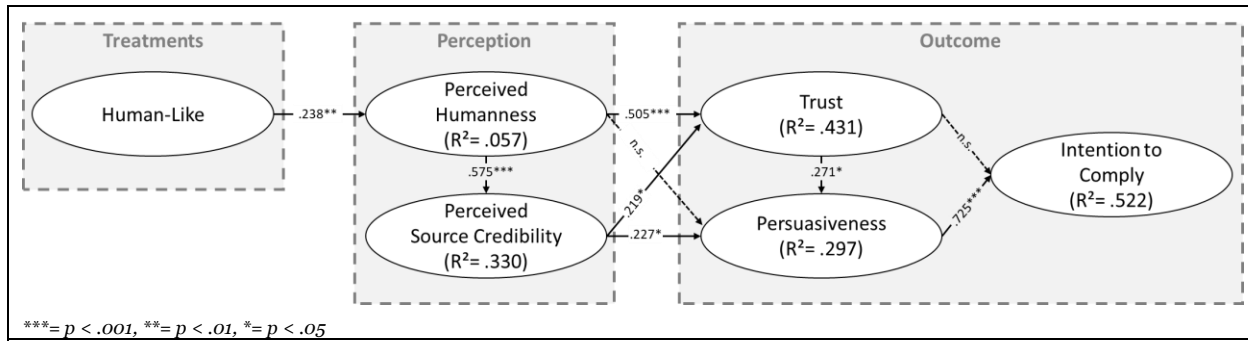
Figure 3. PLS Structural Model (N=116)

The human-like design of our CA (human-like and non-human-like) shows a significant impact on users' perception of humanness (β = .238, p = .005). As a result, we can support hypothesis **H1**, meaning that using social cues in CAs lead to higher levels of perception regarding humanness. Further, we can support **H2** stating that perceived humanness positively influences the perceived source credibility (β = .575, p < .001). This analysis also reveals that hypothesis **H3a** perceived humanness has a significant positive impact on trust (β = .505, p < .001). Additionally, our results indicate a positive effect of source credibility on trust (β = .219, p = .028), which supports **H3b**. In contrast, we found no support for hypothesis **H4a** that postulates an impact of perceived humanness towards persuasiveness (β = .146, p = .194). In the context of COVID-19, we show that source credibility has a significant influence on persuasiveness (β = .227, p = .037), supporting **H4b**. Our results also support **H4c** by indicating a positive and significant influence of trust on persuasiveness (β = .271, p = .034). However, our results do not indicate a significant influence of trust on intention to comply (β = .001, p = .990) and thus we found no support for our Hypothesis **H5a**. Finally, we found a significant effect of persuasiveness on intention to comply (β = .725, p < .001) and therefore our hypothesis **H5b** is supported. All our hypotheses, including their β-value, t-value, and the derived support are summarized in Table 3.

Hyp.	Relationship	β-value	t-value	p-value	Support
H1	Human-like design → Perceived Humanness	.238	2.806	.005**	**Supported**
H2	Perceived Humanness → Source Credibility	.575	9.711	.000***	**Supported**
H3a	Perceived Humanness → Trust	.505	5.606	.000***	**Supported**
H3b	Source Credibility → Trust	.219	2.202	.028*	**Supported**
H4a	Perceived Humanness → Persuasiveness	.146	1.299	.194	Not supported
H4b	Source Credibility → Persuasiveness	.227	2.082	.037*	**Supported**
H4c	Trust → Persuasiveness	.271	2.126	.034*	**Supported**
H5a	Trust → Intention to Comply	.001	0.012	.990	Not supported
H5b	Persuasiveness → Intention to Comply	.725	11.301	.000***	**Supported**
*Note all β-values are standardized	***= p < .001, **= p < .01, *= p < .05*				

Table 3. Results of Hypothesis Tests

Based on Cohen (2013), our R^2 values show a large power for source credibility (R^2 = .330), trust (R^2 = .431), persuasiveness (R^2 = .297), and intention to comply (R^2 = .522), and a small power for perceived humanness (R^2 = .057). Further, trust has a positively impact on persuasiveness, but showed no significance on intention to comply. Therefore, we analyzed the specific indirect effect of trust via persuasiveness on intention to comply which shows significance (trust → persuasiveness → intention to comply, β = .197, p = 0.033) and thus trust is fully mediated by persuasion. Further, our results suggest a mediation between perceived humanness and persuasiveness by trust. However, the specific indirect effect (perceived humanness → trust → persuasiveness, β = .164, p = 0.065) is not significant.

Discussion

The aim of this study was to investigate the relationship between a human-like-designed CA and the intention to comply in the context of hygiene and COVID-19. The results contribute to the current discourse by advancing the understanding of CAs in healthcare contexts and by providing empirical evidence that

human-like design CAs impact the intention to comply. We show that in human-machine-interactions about COVID-19 hygiene information's, users tend to be more convinced to follow recommendations when human-like-design is applied. In this context, we will outline several implications for theory, future research, and practice.

Implications for Theory and Future Research

Our results indicate that perceived humanness does not directly increase persuasiveness. However, the effect of perceived humanness on persuasiveness is fully mediated by trust and source credibility. This implies that the mere presence of perceived humanness is not enough to persuade users. Instead, the perception of humanness is critical to increase other factors related to persuasiveness. Thus, understanding which social cues are related to factors critical for persuasiveness is of high relevance for future research. For instance, a chatbot portraying a local physician (e.g., "Hi, I'm Dr. Jones from your local hospital") might be differently perceived than a generic human personality (e.g., "Hi, I'm John and I ...") regarding source credibility.

Perceived humanness has a strong and highly significant effect on source credibility. From a pure logical perspective, source credibility should be an objective judgement and not influenced by arbitrary situational factors – i.e., the perceived humanness is not a direct indicator of a source's credibility. However, when viewing this effect through the lens of cognitive biases, the observed influence can be explained. In human-to-human interaction, the so called "Halo Effect" is the tendency of humanness to extrapolate one specific trait to the overall impression of an individual or object (Forgas and Laham 2016) – e.g., an influence of a student's name with less appealing surnames on grading (Erwin et al. 1984; Malouff et al. 2014). Future research could study the influence of small errors on the source credibility; for instance, when the information provided by a chatbot is correct and truthful, but it also produces typing errors.

Furthermore, current literature reports a strong influence of trust on user's compliance and therefore intention to comply in COVID-19 contexts (Sarracino et al. 2022). Users are actively seeking counseling by a CA (i.e., users state symptoms and the CA analyses if it is likely to be COVID-19 and what steps to take) and their compliance is driven by trust and not persuasiveness. In our study, intention to comply is driven by persuasiveness and only indirectly by trust (i.e., trust is mediated by persuasiveness). In this context, we would like to offer the following explanation for this contradiction. The service of our implemented CAs was to educate users about hygiene in relation to COVID-19. Hence, the service was not critical or directly related to a life-threatening situation. In contrast, getting counseling in context of a potential COVID-19 infection is highly critical and potential life-threatening. Thus, trust drives intention to comply in critical interactions and persuasiveness and less critical ones. Based on this explanation, we would like to direct future research to investigate when the turning point is (i.e., what situational factors have to change that trust is no longer important, but persuasiveness is and vice versa).

Lastly, we would like to address the issues related to using human-like design to improve persuasiveness. Specifically, reacting to human-like characteristics is an automatic and mindless behavior (Kim and Sundar 2012). It interacts with users' beliefs and decisions, without their knowledge, compromising freewill. Subsequently, using human-like design elements (i.e., social cues) can be seen as unethical. A similar discussion is currently ongoing in the area of digital nudging (i.e., the usage of digital design elements to influence decisions (Mirsch et al. 2017; Schneider et al. 2018). Lembcke et al. (2019) pointed out that the application of digital nudges should only be done when considering freedom of choice (i.e., decisions are not forced by omitting options), goal-justification (i.e., the digital nudge is implemented to achieve pro-social, pro-environment, or pro-self-goals), and transparency (i.e., users are aware of the nudges). Following these recommendations, we should be careful when to implement human-like characteristics to achieve high levels of intention to comply. In the case of preventing and managing a COVID-19 pandemic, we would judge their application as justified. However, for other contexts, future research should engage in an extensive discussion on when and how human-like CA design is ethically justified.

Implications for Practice

Our results highlight the importance of designing a CA with human-like features when aiming to achieve intention to comply in healthcare contexts. Hence, CA designers should consider designing their CA to be human-like to obtain high levels of intention to comply. Nonetheless, applying them unrestrained and freely

to any context can lead to undesired and unethical side effects (e.g., the human-like design of a CAs lead patients to select the wrong treatment option), which should be considered.

Limitations

This study is not free of limitations. Our sample is exclusively comprised of crowd workers, recruited via a commercial crowd working online platform. However, crowd working samples can be considered appropriate for studying general technology purposes (Paolacci and Chandler 2014). Further, our CA was limited by geographical boundaries since it was only available in German language and on German territory. Regarding intention to comply, our study only focused on short-term effects, leaving it open to interpretation if users are still following recommendations long-term. Further, our CA was designed with generic responses that did not take up and evaluate individual answers. This could open up future research opportunities in design science research to show how CAs should be designed to actually act social.

Lastly, we recommend using NeuroIS methods to analyze direct brain effects that indicate specific stimuli for effecting behavioral attitudes, such as trust. As a possible starting point, Riedl et al. (2010) show how NeuroIS methods can be applied in this context (e.g., by using functional magnetic resonance imaging (fMRI)). Due to analyzing the root causes in human minds, this interdisciplinary IS approach can enrich future research directions.

Conclusion

In context of COVID 19 and similar situations (e.g., natural disaster, pandemic of a different virus), it is important to communicate guidelines to the general public in a timely and convincing manner. To avoid possible infections, virus transmissions, and fatigue behavior, complaining with hygiene recommendations is from vital importance. We conducted a between-subject online experiment to better understand the relation of human-like design of a CA and users' intention to comply. Our study contributes to the current discussions by reporting evidence for the influence of a human-like designed CA on the intention to comply in healthcare contexts. Specifically, we find support for a significant impact of a human-like design on the perception of humanness, source credibility, and trust, which are all (directly or indirectly) drivers of the intention to comply. We provide practical implications by underlining the importance of human-like designed CA and its influence on users' intention to comply with COVID-19-related recommendations.

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