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"IS IT COVID OR A COLD?"
AN INVESTIGATION OF THE ROLE OF SOCIAL PRESENCE, TRUST, AND PERSUASIVENESS FOR USERS' INTENTION TO COMPLY WITH COVID-19 CHATBOTS

Research Paper

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Abstract

The COVID-19 pandemic challenged the existing healthcare system by demanding potential patients to self-diagnose and self-test a potential virus contraction. In this process, some individuals need help and guidance. However, the previous modus-operandi to go to a physician is no longer viable because of the limited capacity and danger of spreading the virus. Hence, digital means had to be developed to help and inform individuals at home, such as conversational agents (CA). The human-like design and perceived social presence of such a CA are central to attaining users' compliance. Against this background, we surveyed 174 users of a commercial COVID-19 chatbot to investigate the role of perceived social presence. Our results provide support that the perceived social presence of chatbots leads to higher levels of trust, which are a driver of compliance. In contrast, perceived persuasiveness seems to have no significant effect.

Keywords: Smart Health, COVID-19, Conversational Agent, Social Presence, Compliance.

1 Introduction

In the outgoing year of 2019, the World Health Organization (WHO) drew attention to several cases of pneumonia with an unknown cause. The previously unknown coronavirus (SARS-CoV-2-Virus) was found to trigger this symptom, and the contagious disease was named COVID-19 (World Health Organization 2021a). The virus denotes a family of viruses causing illness with symptoms ranging from loss of taste and smell to difficulty breathing. After declaring the outbreak an emergency of international concern and the rapidly rising number of cases, the WHO characterized it as a worldwide pandemic in March 2020 (World Health Organization 2021a). Due to a high risk of infection, the WHO and the countries of the world gave recommendations and measures to protect personal health respectively to contain the infections (European-Centre-for-Disease-Prevention-and-Control 2020). One central component of these recommendations is social distancing (Venkatesh and Edirappuli 2020).

Individuals had to be counseled at home regarding various topics, such as self-testing, social distancing, and hygiene measures to ensure social distancing (European-Centre-for-Disease-

Prevention-and-Control 2020). The reduction in human contact coupled with a greater need for medical consultation brought a wave of digitalization in medicine (Mumm et al. 2021). In this context, COVID-19 presents new challenges to medical professionals and potential users, for instance, a COVID-19 infection can have widely different progressions (ranging from no symptoms to potentially dying because of failure of respiratory functions), and users have different levels of knowledge about the disease and are inexperienced because of the novelty of COVID-19. Consequently, various means of communication were applied, ranging from traditional approaches, such as flyers, websites, forms, and TV spots (Michigan-Government 2021), to new digital approaches, including Conversational Agents (CAs), to inform all citizens (Miner et al. 2020). CAs are "software-based systems designed to interact with humans using natural language" (Feine et al. 2019, p.1). One example in the context of COVID-19 is the chatbot of the World Health Organization, which was launched in March 2020 and offered information regarding the prevention of a COVID-19 infection via WhatsApp (World-Health-Organization 2021b).

Besides the ability to provide an easy way of communication via natural language, CAs can potentially affect users' affection, cognition, and behavior (Diederich et al. 2022). CAs can be designed human-like via social cues (e.g., having a name, greeting users, using emoticons), which leads to a perception of social presence (Gefen and Straub 2004). This perception of social presence leads users to subconsciously perceive a CA as a social actor and react to it similar to a human-to-human interaction (Nass et al. 1994). In effect, a CA's perceived social presence can induce a perception of trustworthiness (de Visser et al. 2016), enjoyment (Lee and Choi 2017), and persuasiveness (Diederich, Lichtenberg, et al. 2019). Thus, besides improving the technical capabilities of CAs (i.e., the ability to process natural language), researching the human-like design of CAs and the resulting effect on users constitutes an important area for research and practice (Diederich et al. 2022; Feine et al. 2019).

Because of the importance of designing effective CAs for COVID-19 counseling (Miner et al. 2020), many studies have been conducted in recent years (Almalki and Azeez 2020). Regarding the users' compliance (also often called adherence) with recommendations of these CAs, various factors have been identified, ranging from the importance of accuracy (Espinoza et al. 2020), user characteristics (e.g., disposition to trust or being at high risk of infection (Dennis et al. 2020)) to situational factors (e.g., the severity of symptoms (Dennis et al. 2020)). However, to the best of our knowledge, it remains unclear how the perception of social presence interacts with a user's intention to comply with recommendations of a COVID-19 CA. Understanding the role of social presence plays in this context would open up the possibility to adapt the CAs human-like design to ensure users' compliance, which would provide an additional way to increase CAs' effectiveness in reducing the strain on the health infrastructure (i.e., less unnecessary testing and hospital visits as well as a reduced risk of infection) (Judson et al. 2020). Furthermore, such knowledge is not only relevant for the COVID-19 pandemic but also for future crises where compliance is of high importance, such as natural disasters (Han et al. 2015). Against this background, we aim to investigate the following research question:

> **RQ:** *How does the perceived social presence of a COVID-19 CA influences the user's intention to comply with the CA's recommendations?*

To address this research question, we conducted a survey with 174 users of a commercial COVID-19 chatbot (called SMASS) provided by n4medicine AG, which is available in German-speaking countries (e.g., Germany, Austria, Switzerland). The CA provides users with counseling regarding a potential COVID-19 infection and provides a recommendation (e.g., "seek medical help" versus "there is no need to seek medical help"). Our results reveal that social presence leads to higher levels of perceived trust and persuasiveness. However, users' intention to comply with the CA recommendation is affected by the perceived trust and not by the CA's persuasiveness. Against this background, we deduct that trust drives the context of COVID-19 because it is crucial for one's life and health. Thus, the design of CAs should be sensitive to the context in which it provides recommendations (e.g., "get a routine checkup" versus "you have a life-threatening virus infection and need immediate attention"), providing a trust-building interaction in critical situations to ensure compliance.

2 Research Background

In the following subsections, we will provide an overview of current developments regarding CAs in the context of health, focusing on the COVID-19 pandemic. Also, we will summarize the current literature on the human-like design of CAs and the resulting perception of social presence.

2.1 Conversational Agents for Health and COVID-19

In recent years the technology behind CAs has rapidly improved (Berg 2015; McTear 2017; McTear et al. 2016), enabling CAs to be applied in various contexts, ranging from customer service (Barrett et al. 2015) to healthcare (Laranjo et al. 2018). While human service encounters are limited by time and space constraints, CAs can support users at any time, place, and provide a comfortable and convenient user experience (Verhagen et al. 2014). Furthermore, CAs provide convenient access to information or managing user requests, covering typical service tasks (e.g., searching for information or writing e-mails) (Gnewuch et al. 2018; Marinova et al. 2017) and personal assistance (e.g., Siri or Alexa for everyday tasks) (Burton and Gaskin 2019; Danielescu and Christian 2018).

Regarding CAs for health, one of the first CAs ever was ELIZA, developed to mimic a psychotherapist (Weizenbaum 1966). Since then, CAs have been applied for various healthcare contexts (Laranjo et al. 2018). Examples from literature are stress management (Shamekhi et al. 2017), sexual health advice (Kobori et al. 2018; Wilson et al. 2017), diabetes medication (Sosale et al. 2018), and healthy eating (Casas et al. 2018). In these and other contexts, CAs have displayed a remarkable ability to provide a convenient and enjoyable user experience, surpassing the ability of traditional means, such as static websites and forms (Laranjo et al. 2018).

For COVID-19, CAs were applied to inform users about various aspects of preventing an infection, including disseminating health information and knowledge, self-triage and personal risk assessment, monitoring exposure and notifications, tracking COVID-19 symptoms and health aspects, and combating misinformation and fake news (Judson et al. 2020). For instance, the chatbot Clara run by the Centers for Disease Control and Prevention is a dedicated COVID-19 self-checking tool. It is intended to assist the user in deciding about appropriate medical care in case of a suspected COVID-19 infection. The chatbot asks several questions, including vaccination status, living conditions, and symptoms. After this assessment, the chatbot gives a recommendation, such as to take a COVID-19 test and stay at home (CDC 2020).

For these COVID-19 CAs to be effective, users must comply with the recommendations (Dennis et al. 2020). In medicine and psychology, compliance has no clear definition, and other terms, such as adherence, co-operation, mutuality, and therapeutic alliance, are used synonymously (Kyngäs et al. 2000). In this paper, we follow the understanding of compliance as the patient's willingness and ability to follow health-related prescriptions (e.g., treatment plans) of healthcare experts (Murphy and Coster 1997). According to Lu and Zhang (2019), compliance behavior results from physician-patient agreement. This agreement is achieved by discussing possible treatment options and agreeing on one of these therapeutic measures. In this context, the decision of a patient to be compliant with a physicians' advice of the physician depends on various factors (Heiby et al. 2005), including relational factors, such as trust (i.e., does the patient trust the physician) (Hojat et al. 2010), and situational factors, such as persuasiveness (i.e., how well the physician can present information to influence the patients thinking) (Segal 1994). Translated to the context of COVID-19 CAs, users are compliant with the recommendation of the CA when they intend to behave as recommended (e.g., self-isolate, get tested, or see a physician). In this context, the user's behavior depends on how the CA and, by extension, its advice is perceived (Dennis et al. 2020; Liu and Sundar 2018). For instance, a perfectly accurate recommendation might not be followed when the CA is not perceived as trustworthy (Dennis et al. 2020).

2.2   Human-like Design of Conversational Agents

The tendency of humans to attribute human-like characteristics to objects is a deeply ingrained bias (Howard and Kunda 2000). For instance, objects like cartoon characters (e.g., Donald Duck) and animals (e.g., smiling monkey) are associated with human characteristics (Epley et al. 2007). This process also occurs by users of CAs (e.g., attributing Alexa or Siri with a Gender) (Araujo 2018; Shum et al. 2018). In this context, the "Computers are Social Actors" (CASA) paradigm (Nass et al. 1994) and the Social Response Theory (Nass and Moon 2000) were developed to explain this phenomenon.

Regarding CASA, Nass et al. (1994) found that users interact with computers socially and communicatively when the computer system is equipped with human-like features (e.g., having a name or gender). Users subconsciously attribute the computer with a level of humanness and social presence, despite continuously knowing that a computer is a machine and not a human being (Nass and Moon 2000). Furthermore, users react to the level of perceived humanness and social presence by subconsciously applying social norms, such as assigning gender and applying gender stereotypes (Lang et al. 2013; Nass et al. 1994; Nass and Moon 2000).

Furthermore, following the Social Response Theory, a CA equipped with social cues triggers automatic responses by users, such as saying 'thank you' to a CA at the end of the interaction (Feine et al. 2019; Nass and Moon 2000). The intensity and extent of these automatic responses depend on the CA's perceived level of humanness and social presence (Gong 2008). For instance, Reeves and Nass (1996) reported that users were more likely to respond politely and gratefully to a CA when the CA displayed a wide array of human-like features. Furthermore, recent studies report that users have various affective, cognitive, and behavioral responses to the human-like design of a CA, including increased enjoyment (Lee and Choi 2017), perceived persuasiveness (Diederich, Lichtenberg, et al. 2019), and attributed trustworthiness (Araujo 2018).

To systematically categorize and describe called social cues of CAs, Seeger et al. (2018) proposed three fundamental types: human identity, verbal cues, and non-verbal cues. Examples of human identity are name (Cowell and Stanney 2005), avatar (Gong 2008), and gender (Nunamaker et al. 2011). The verbal cues dimension includes cues like turn-taking (Gong 2008), syntax and word variability (Seeger et al. 2018), and self-reference/ self-disclosure (e.g., "I like …") (Schuetzler et al. 2018). The third dimension (non-verbal cues) includes features, such as the use of emoticons (Feine et al. 2019) and dynamic response delays (Gnewuch et al. 2018), accompanied by the associated blinking dots (de Visser et al. 2016).

3   Research Model and Hypothesis Derivation

Our research aims to investigate the interrelation of the perceived social presence of a COVID-19 CA and its relation to users' compliance with its recommendations. Based on the social response theory (Nass and Moon 2000) and CASA (Nass et al. 1994), we develop six hypotheses on how social presence increases perceived trust and persuasiveness, which are drivers of users' intention to comply. Figure 1 summarizes our research, including constructs and their relation. In the following paragraphs, we provide a details account of the derived hypotheses.
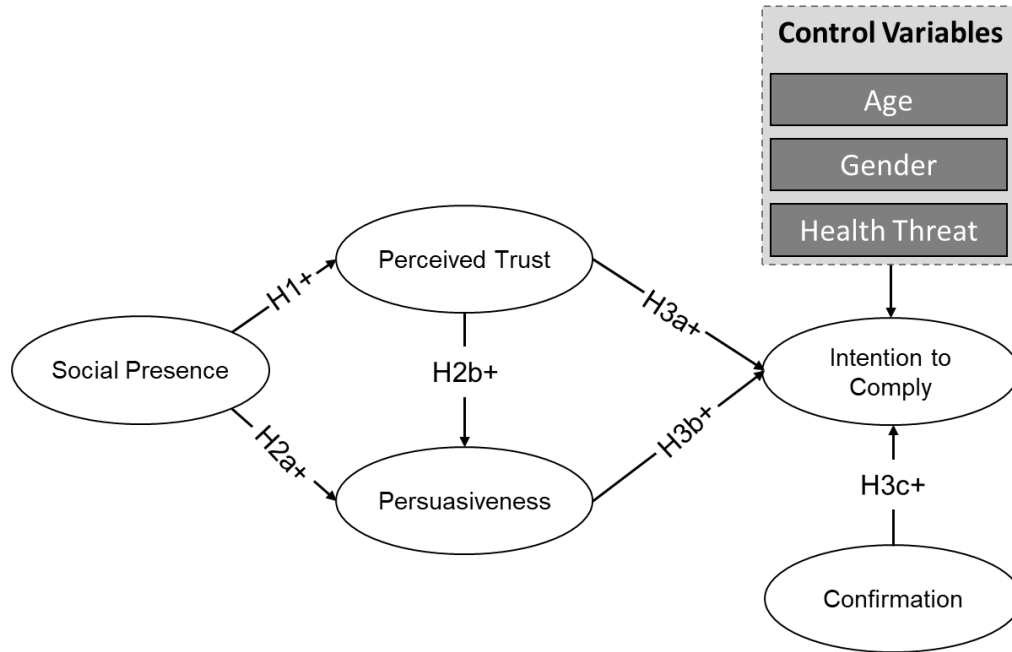
Figure 1. Research Model

3.1 Social Presence and Trust

The perceived social presence is a user's feeling of a sense of human contact, a sense of human warmth, or perceiving the CA's interaction style as sociable (Short et al. 1976). Following the CASA paradigm (Nass et al. 1994), users of computers apply social norms and behavior when a computer displays human-like traits. Based on the social response theory (Nass and Moon 2000), this perception of social presence leads humans to subconsciously respond to them similar to human-to-human interaction. For instance, social presence can influence the trust attributed to a CA.

Trust is the belief that another entity (including computers and humans) will provide help in obtaining one's goals, despite uncertainty and vulnerability (e.g., the belief that a COVID-19 CA will provide accurate and helpful counseling) (Lee and See 2004). Research by Lankton et al. (2015), among others, has found a significant relationship between the human-like design of technologies and a user's trust in the system. Similarly, the work of Toader et al. (2020) has been able to highlight that users have a higher trust towards a socially present chatbot than towards a chatbot that is seen as antisocial. On this basis, the following hypothesis is formulated:

> **H1:** *Perceived social presence positively impacts users' trust in the CA.*

3.2 Persuasiveness

The perception of social presence can be related to the perception of persuasiveness. In the context of human-computer-interaction, persuasiveness is the ability of a computer to change the user's attitude towards an intended position (e.g., to take COVID-19 more seriously and follow related recommendations) (Lehto et al. 2012). Thus, we follow the understanding that persuasiveness is the outcome of the interaction with a system (e.g., CA) and not a perceived characteristic of it. In this context, research by Paskojevic (2014) has shown that the Social Presence Theory can be applied to explain the persuasiveness of websites. The results indicate that the persuasiveness of a website is higher when it is perceived as socially present by the user. In context of CAs, Diederich, Lichtenberg et al. (2019) reported that a human-like designed CA leads to higher levels of persuasiveness in the context of environmental sustainability beliefs. Therefore, it is hypothesized that the associated social

presence influences the perceived persuasiveness of a COVID-19. Therefore, the following hypothesis is put forward:

H2a: *Perceived social presence positively impacts the user's perceived persuasiveness of the CA.*

Overall, persuasiveness is driven by many factors, including the ability of the system to support the primary task, its perceived credibility and sociability, and unobtrusiveness (Lehto et al. 2012). Because trust can be understood as the perception of a system to be capable and able to help in situations of uncertainty and vulnerability (Lee and See 2004), it can be seen as a measure of a system's perceived credibility. Hence, trust can be expected to positively influence a user's perception of a system's persuasiveness. In this context, Lehto et al. (2012) reported that trust encompassed by credibility positively affects perceived persuasiveness, increasing the actual usage of an IS system. In CA research, similar results have been reported. For instance, Sillice et al. (2018) found that a relational CA is more respected, liked, and trusted, leading to a user's positive mindset and behavior change. Against this background, we hypothesize:

H2b: *Users' trust in the CA positively impacts the perceived persuasiveness of the CA.*

3.3   Intention to Comply

In the context of a COVID-19 CA, the intention to comply with recommendations can be understood as the willingness and ability to follow the COVID-19-related recommendations (Dennis et al. 2020; Murphy and Coster 1997; Nadarzynski et al. 2019). In this context, trust can be expected to be a vital driver of compliance (Hojat et al. 2010). For instance, research by Lowry et al. (2014) has examined patient compliance behaviors and found that the attitude to behave in compliance with the rules is positively influenced by the patient's trust in the physician. Similarly, when using chatbots in the medical field, the user must have a high level of trust in the CA (Nadarzynski et al. 2019). Furthermore, Dennis et al. (2020) reported that trust is a strong predictor of a user's compliance with a CA's advice. Therefore, we formulate the following hypothesis:

H3a: *Trust positively impacts the user's intention to comply with the CA's recommendations.*

Besides trust, the perceived persuasiveness of a CA can be expected to drive the user's intention to comply. In general, individuals are more likely to follow the recommendations of a credible and trusted source (Wang and Benbasat 2005). For instance, in current healthcare literature, Hojat et al. (2010) reported a significant link between interpersonal trust and compliance with a physician's recommendation. Additionally, Lu and Zhang (2019) found that the perceived quality of digital health information, decision-making preference, and physician-patient concordance positively mediates patient compliance. In the context of CAs, Diederich, Lichtenberg, et al. (2019) reported a significant correlation between a CA's perceived persuasiveness and a user's behavioral beliefs. Based on these findings, the following hypothesis is formulated:

H3b: *Persuasiveness positively impacts the user's intention to comply with the CA's recommendations.*

When processing information, individuals tend to display a confirmation bias (Wason 1960). Confirmation bias is the tendency to favor information that confirms or supports prior beliefs and values and, consequently, devalue opposing information (Nickerson 1998). In the context of healthcare, patients tend to believe a physician more when the diagnosis matches their expectations. In contrast, patients tend to get a second opinion when the diagnosis opposes their expectations (Wu et al. 2018). Against this background, we deduct the following hypothesis:

H3c: *Confirmation bias positively impacts the user's intention to comply with the CA's recommendations.*

4   Research Design

To test the derived hypotheses, we conducted an online questionnaire, which was accessible by the users of the chatbot after the interaction for the covid assessment and resulting recommendation. This section will outline our sampling and the data collection process. Furthermore, we will describe our construct measurements, including statistical analysis.

4.1   Sampling and Data Collection

| Interaction | Recommendation |
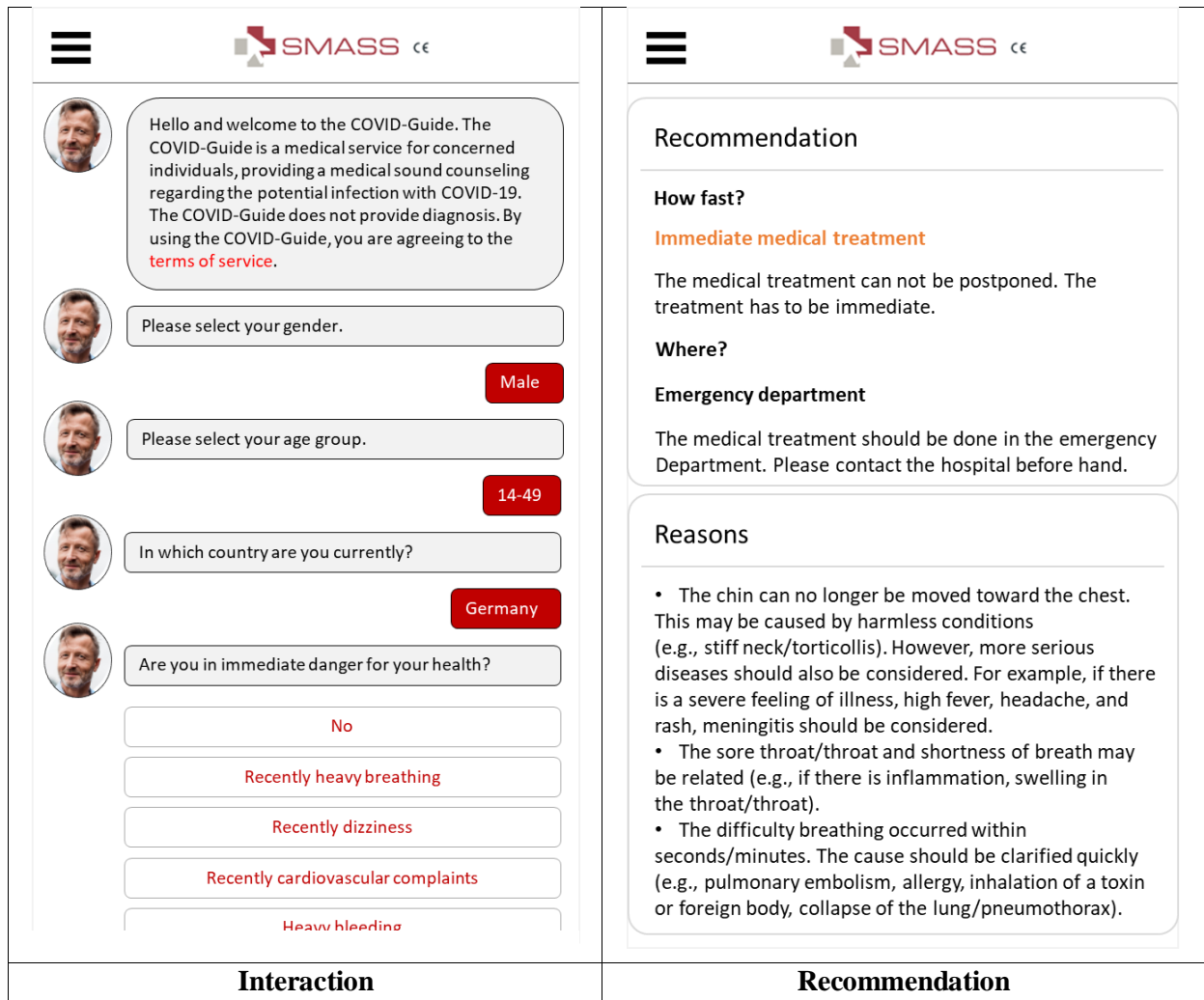
Note that the interfaces are translated from German to English.

Figure 2. User Interface of the SMASS COVID-19 Chatbot provided by in4medicine AG

Our survey was conducted amongst users of a commercially available COVID-19 chatbot (Figure 2). The COVID-19 chatbot is equipped with social cues, including a human 2D avatar, gender, and greeting the users ("Hello and welcome, …"). It provides counseling regarding the need to go to a COVID-19 testing center or hospital. Also, if the user has described symptoms unrelated to potential COVID-19 infection, corresponding recommendations are provided (e.g., advising to go to the emergency room because of a potential poisoning). The chatbot asks various questions regarding a potential COVID-19 infection during the counseling, including current symptoms, age, and gender. Answers are predefined, and users can select them via predefined buttons or, in some cases, search functions. In the end, the chatbots either recommend what the users should do (e.g., get tested or seek

treatment for COVID-19), including recommendations besides COVID-19 (e.g., identifying poisoning and recommending seeking immediate medical help).

After the interaction with the chatbot, the users were asked to participate in a survey voluntarily. The survey took place immediately afterward, ensuring that the participants could report directly on their first impression and overall experience. The survey was conducted in the first half of 2021, and, overall, 175 users participated, and one of them failed the attention check, leading to an overall sample size of 174. In our sample, 71% of users identified as female. Because of the way the CA asked for the age of users, the age was collected via a group variable which divided participants into young (younger than 49 years; 58%) and old (50 years or older; 42%).

4.2 Construct Measurements

We measured social presence (Gefen and Straub 1997), trust (Hall et al. 2002), persuasiveness (Lehto et al. 2012), confirmation (Kim et al. 2009), and intention to comply (Bulgurcu et al. 2010). The items were adapted to the research context and measured using a 7-point Likert scale, ranging from 1 ("fully disagree") to 7 ("fully agree"). The control variables, age, and gender were directly collected through the chatbot. Lastly, the control variable of perceived health threat (based on Han et al. (2015)) was included with three items in the questionnaire.

Constructs and Items	Mean	SD	Loadings
Social Presence (Cronbach's α = .942, CR = .961, AVE = .896) (Gefen and Straub 1997)			
I felt a sense of human contact with the chatbot.	3.548	1.817	.936
I felt a sense of human warmth with the chatbot.	3.285	1.775	.960
I felt a sense of sociability with the chatbot.	3.188	1.809	.944
Trust (Cronbach's α = .908, CR = .943, AVE = .846) (Hall et al. 2002)			
I perceived the chatbot as thoroughly and conscientiously.	5.565	1.445	.860
I trust the decisions and suggestions of the chatbot.	4.703	1.636	.937
Overall, I trust the chatbot.	4.870	1.620	.960
Persuasiveness (Cronbach's α = .762, CR = .857, AVE = .675) (Lehto et al. 2012)			
The chatbot has an influence on my thinking regarding COVID-19.	3.632	2.006	.842
The chatbot is personally relevant for me.	4.766	1.683	.852
The chatbot makes me reconsider my thinking about COVID-19.	3.067	1.860	.766
Intention to comply (Cronbach's α = .851, CR = .915, AVE = .771) (Bulgurcu et al. 2010)			
I am following/did follow the chatbot's suggestions.	5.243	1.605	.920
I am complying/did comply with the recommendation of the chatbot.	5.310	1.663	.879
I am following/plan to follow the instructions recommended by the chatbot.	5.515	1.597	.834
Confirmation (Cronbach's α = .726, CR = .871, AVE = .784) (Kim et al. 2009)			
The chatbot confirmed what I expected.	5.293	1.552	.863
~~The chatbot recommendation was different from what I expected. (r)~~	2.736	1.902	-.564
Overall, my expectations were confirmed by the chatbot.	5.393	1.465	.908
Perceived Health Threat (Cronbach's α = .830, CR = .897, AVE = .743) (based on Han et al. 2015)			
COVID-19 is a serious threat.	4.674	1.992	.839
COVID-19 is a serious threat to my health.	4.904	1.821	.885
COVID-19 is a serious threat to my social environment (friends and family).	5.619	1.556	.851
CR = Composite Reliability, AVE = Average Variance Extracted, SD= Standard Deviation; r= reverse coded			
Note that all items were translated to German for the survey.			

Table 1. Operationalization of Latent Constructs

In Table 1, all measured constructs and the associated factor loadings, Cronbach's α, composite reliability (CR), average variance extracted (AVE), mean, and standard deviation (SD) are summarized. The data was analyzed using Smart PLS (Version 3) (partial least square bootstrapping for structural equation modeling). In total, 15 items (excluding the control variables) were present, and, therefore, a sample size of at least 150 was required (Nunally 1970). Our sample exceeds this threshold with a size of n=174. We removed one item with a factor loading below .60 (Gefen and Straub 2005). Following Nunally (1970), all constructs showed a sufficient CR (> .70), and the required value of Cronbach's α (> .70) and AVE (> .50) was reached (Cortina 1993).

Harman's single-factor test was performed to test for a common factor (Podsakoff and Organ 1986). All measurement items were subjected to exploratory factor analysis. We find no evidence for such a bias in our data based on this analysis. The total variance extracted by one factor is 43%, which is below the threshold of 50% (Podsakoff and Organ 1986). No single factor emerged from the analysis, concluding that our study is free of a common method bias. Furthermore, all measured constructs exhibit sufficient reliability. Results of convergent and discriminant validity analyses also indicate sufficient validity (see Table 2). In this context, the convergent validity of all constructs is given due to a higher AVE than .50 (Hair et al. 2010). Finally, to assess the discriminant validity, all square roots of the AVE (in bold in Table 2) are higher than the correlations between the constructs (Fornell and Larcker 1981) (see Table 2). To conclude, our measurement model is suitably reliable and valid.

| Constructs	1	2	3	4	5	6
1. Intention to Comply	**.878**					
2. Confirmation	.534	**.885**				
3. Health Threat	.138	.080	**.858**			
4. Persuasiveness	.444	.336	.210	**.821**		
5. Social Presence	.304	.269	.143	.534	**.947**	
6. Trust	.629	.490	.097	.610	.489	**.920**

Table 2. Operationalization of Latent Constructs

5 Results

We used the PLS method to estimate the theoretical structural model described above. The bootstrapping re-sampling method with 5,000 samples was used to assess the significance of the paths. All results with the respective path coefficients and significance levels are visualized in Figure 3.

The perceived social presence shows a significant effect on the trust in the chatbot (social presence → trust, β = .489, $p < .001$) and on the persuasiveness of the chatbot (social presence → persuasiveness, β = .310, $p < .001$). Hence, our results support **H1** and **H2a**. Furthermore, a significant effect was discovered for trust in the chatbot and persuasiveness (trust → persuasiveness, β = .458, $p < .001$), supporting **H2b**. In this context, the direct effect of social presence on intention to comply is β = .258, $p < .001$, indicating that this relationship is partially mediated.

Regarding the influence of trust on intention to comply (**H3a**), our results provide support for a significant effect (trust → intention to comply, β = .424, $p < .001$). However, our results do not support **H3b** regarding the effect of persuasiveness on intention to comply (persuasiveness → intention to comply, β = .094, $p = .133$). The confirmation of one's expectation regarding a potential COVID-19 infection shows a significant effect on the intention to comply (confirmation → intention to comply, β = .258, $p < .001$). In conclusion, we find support for all hypotheses except **H3b** (see Table 3). According to Cohen (2013), the R^2 values show a large explanatory power (> .25) for persuasiveness (R^2 = .445), and intention to comply (R^2 = .494). For perceived trust (R^2 = .239), the R^2 indicates a medium power (.13 < x < .25).
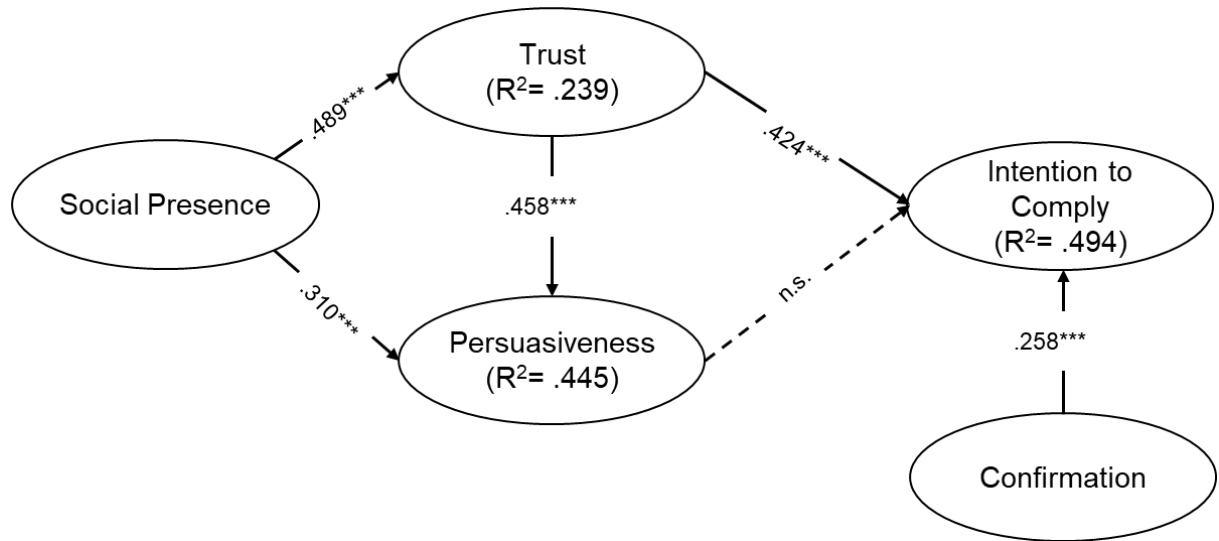
***= p < .001; **= p < .01; *= p < .05; n.s.= not significant*

Figure 3. PLS Structural Model (N=174)

In addition, we also conducted a post hoc analysis of the effect of control variables (age, gender, perceived health threat) on the latent variable (intention to comply). Gender has a significant effect (β = -.138, p = .011). The binary variable age (young/old) has no significant effect (β = .111, p = .056). Lastly, health threat has no significant effect on the intention to comply (β = .061, p = .318).

Hyp.	Relationship	β-value	p-value	Support
H1	social presence → trust	.489	.000	**Yes**
H2a	social presence → persuasiveness	.310	.000	**Yes**
H2b	trust → persuasiveness	.458	.000	**Yes**
H3a	trust → intention to comply	.424	.000	**Yes**
H3b	persuasiveness → intention to comply	. 094	.133	*No*
H3c	confirmation → intention to comply	.258	.000	**Yes**
Note that all β-values are standardized.				

Table 3. Results of Hypothesis Tests

6 Discussion

Our study aimed to investigate the relationship between the perceived social presence of a COVID-19 CA and the resulting user's intention to comply with its recommendations. Our results contribute to improving our understanding of the interaction of CAs and users for healthcare purposes, providing empirical evidence for the positive effect of social presence on trust, which drives a user's intention to comply. However, we find no support for an effect of persuasiveness on the user's intention to comply.

Our results position social presence as a driver of compliance with the recommendation of COVID-19 CAs. They support current literature on the positive relation of social presence, trust (Gefen and Straub 2004), and persuasiveness (Diederich, Lichtenberg, et al. 2019). Partially mediated by trust, social presence can positively influence users' intention to comply with the recommendations. This positions a trustworthy and human-like design of a CA as an important facilitator of compliance with COVID-19 CAs and beyond. Furthermore, we contribute to our knowledge in the context of CASA

and social response theory by showing how the perception of social presence influences our perception and subsequent decisions.

6.1   Implications for Theory and Future Research

Extending from our results regarding the importance of trust for compliance, we see potential in exploring other cognitive biases of humans related to social cues. For instance, the perceived similarity is associated with the similarity bias (Kanter 1977). In the context of a COVID-19 CA and the importance of trust, the question arises if a CA equipped with a similar identity to the user (e.g., a young medical student for student users) can achieve similar levels of trust and compliance compared to a CA equipped with an identity that is intended to be associated with competency and trust (e.g., a seasoned medical professional).

Our results indicate that users' expectations drive their compliance with a COVID-19 CA's recommendations regarding the influence of confirmation bias. Subsequently, we propose investigating how CAs should be designed to influence the user's need for confirmation. For instance, the need for information is stronger in a situation of high importance and risk (Mills and Sullivan 1999). The CA could try to increase or decrease the perception of such importance and risk, depending on the situation and need for compliance.

On a different note, trying to prevent users from subconsciously following cognitive biases could be a potential avenue for future research. For instance, a debiasing training for users regarding biases, such as the confirmation bias (Nickerson 1998), might be a means for COVID-19 CAs to achieve a higher level of users' understanding. For instance, Lim et al. (2000) demonstrated that users of an information system were less likely to follow cognitive biases when multimedia was used instead of raw text. We would expect CAs to have similar effects. Nonetheless, future research might lead to deeper insights into how and why CAs can unbias users and how this could be a tool to improve compliance.

In a similar direction, investigating ways to reach users that would typically not use these CAs is highly important. It can be assumed that users of a COVID-19 CA already expect a potential COVID-19 infection, seeking confirmation. In contrast, users assuming no infection, despite clear symptoms, should use a COVID-19 CA but might be reluctant to do so. In this context, we see recent research on fake news (Kim and Dennis 2019) and on how to break the cycle of self-serving bias (Miller and Ross 1975) and confirmation bias (Nickerson 1998), which lead to self-contained and self-reinforcing beliefs and behavior, as a potential starting point. Staying within the scope and results of our study, extending on the results of Kim and Dennis (2019), a COVID-19 CA should transparently disclose the sources of information because transparency can increase trust (Felzmann et al. 2019).

Lastly, 'tricking' users into complying stands against the goal of informed consent (Nijhawan et al. 2013). Instead of 'imposing" certain behavior on users, users should be able to make individual and informed decisions. In this context, designing CAs to foster a perception that favors one decision over the other can be perceived as unethical. However, any design of a CA influences the user. For instance, too many social cues lead to uncanniness (Mori 1970), and no social cues are impossible because leaving out certain cues is also a cue (e.g., not using emoticons can be perceived as unfriendly) (Gautam et al. 2015). Thus, designers have to make continuous decisions on how to design the CA. In this context, we would call researchers to explore the ethical dimensions of such decisions and develop corresponding guidelines. The current discourse on ethical digital nudging could provide a starting point in this context. For instance, Lembcke et al. (2019) propose transparency, justification, and freedom of choice as the main aspects of ethical digital nudging. Transferred to the context of CA, we have to think about how to make the human-like design and the intention behind it transparent. Similarly, the justification for a human-like design intended to influence the decision of the user has to be either based on prof-self (e.g., the CA is intended to help the user), pro-society (e.g., the CA is intended to improve society), or pro-environment (e.g., the CA is intended to increase environmental sustainability). Lastly, the user has to retain their freedom of choice, i.e., following the CAs instruction is not perceived as the only option.

6.2   Implications for Practice

Based on our results, practitioners should equip their COVID-19 CAs with a set of human-like features (i.e., social cues). Doing so can increase the probability of users complying with the recommendations. In extension, decision-makers should consider requiring such CAs to be implemented with social cues. Otherwise, a development process driven by a "no-nonsense" and technology-focused mindset could lead to an ineffective result.

Furthermore, a relational communication strategy is advised to build trust between a user and CA. Based on our results, such a communication strategy should be superior compared to purely informative or persuasive communication strategies. A starting point is the work of Söllner et al. (2012), who outlined drivers of trust with three dimensions: performance (e.g., competence, information accuracy), processes (e.g., control, predictability), and purpose (e.g., motives, faith). Hence, a CA should appeal to these factors to ensure compliance. For instance, providing transparency can be seen as a prerequisite for trust and, therefore, compliance (Felzmann et al. 2019).

Lastly, finding confirmation for one's prior expectations influences the users' intention to comply with the CA's recommendations. Hence, the CA should address users' prior expectations by debiasing users regarding their confirmation bias. For instance, research by Roy and Lerch (1996) has shown that users are less prone to follow their biases when supported in their information processing.

6.3   Limitations

Our study is not free of limitations. First, our study was conducted as a follow-up survey after the interaction of users and a commercial COVID-19 CA. Hence, our sample is not free of a selection bias. Only users willing to voluntarily participate were included, and individuals not interested in using such a CA were not part of the sample. Additionally, the CA was only available in German-speaking countries and the German language, limiting the sample. Similarly, we had to factor in users' time constraints and requirements of the CA provider into our survey design. In effect, we had to keep the survey short to ensure participation and prevent users from quitting.

The design of the commercial COVID-19 CA had some human-like features, such as name, avatar, and gender, but was not equipped with other common elements, such as using emoticons (Beattie et al. 2020), a human-like name (Araujo 2018), or frequent self-reference (e.g., "I am...") (Lee and Choi 2017). Furthermore, the CA provided quick reply buttons (i.e., a selection of predefined answers) for users. Diederich, Brendel et al. (2019) reported that such quick reply buttons harm the perceived humanness and social presence. In the end, this specific design constitutes a limitation of our results. Hence, future research should explore how different social cues and combinations influence users' intention to comply (e.g., showing empathy for users who have doubts or fears).

Lastly, our study setup can be characterized by a high level of realism. Participants in our survey were actually seeking recommendations from the CA, and compliance has real-world consequences. However, it lacked the controllability of other approaches, such as laboratory experiments with multiple CA treatments (Dennis and Valacich 2001). Hence, we cannot attribute the observed effects to specific social cues.

7   Conclusion

Completing the recommendations of a counseling COVID-19 CA is paramount to its effectiveness. If users do not comply, the healthcare infrastructure (including testing centers) can be overloaded by COVID-19 free individuals, while individuals needing testing and subsequent treatment are not attending. Besides providing information, CAs can also display a human-like design and elicit a perception of social presence. In this study, we find support for the positive effect of social presence for users' compliance with the recommendations of a COVID-19 CA. Specifically, we find that social presence increases the trust in a CA, which is a key driver for users' intention to comply. In contrast,

we find no support for a similar effect of a CA's perceived persuasiveness. Against this background, our study makes three contributions. First, we provide evidence for the importance of social presence in the context of COVID-19 CA design because it significantly increases the trust placed in the CA. Second, we provide empirical evidence for the importance of trust and users' confirmation of expected counseling outcomes for users' intention to comply. Lastly, we provide implications for practice by highlighting the importance of a human-like design for COVID-19 CAs based on their ability to increase users' intention to comply with the CA's recommendations.

8   Acknowledgements

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