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The Effect of Social Chatbot Avatar Presentation on User Self-disclosure

Short Paper

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Abstract

The emergence of artificial intelligence has boosted the development and utilization of chatbots that can satisfy both users' task-oriented needs, such as information search for purchase, and their social needs, such as self-disclosure for rapport-building. While much research has focused on its usage in the commercial context, little effort has been paid to examine social chatbots for psychotherapy, where facilitating relationship formation is crucial in chatbot design. Inspired by prevalent chatbot applications and drawing on the literature on visual cues and self-disclosure, this paper aims to 1) explore the effects of different presentations of social chatbot avatars (text, profile, and background) on users' self-disclosure, along with the mediating role of self-awareness, and 2) understand the moderating role of chatbot gaze directions (direct gaze and averted gaze). The proposed studies will theoretically contribute to literature regarding human-robot interaction. Research findings will also provide substantial practical implications for chatbot design.

Keywords: Social chatbots; self-disclosure; avatar presentation; self-awareness; gaze direction

Introduction

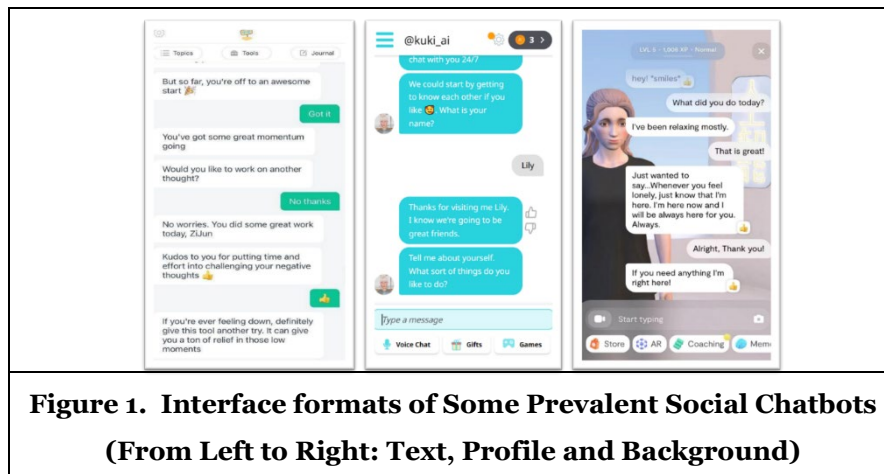
Over the past five decades, artificial intelligence has made significant advancements, leading to the development of chatbots that are now gradually being used on various social platforms and websites (Araujo, 2018). These chatbots¹ can generally be categorized into task-completion chatbots and social chatbots (Shum et al., 2018). Unlike task-completion chatbots that function only under explicit instructions, social chatbots have the ability to engage in profound conversations and establish relationships with users, making them particularly useful in psychotherapy (Croes & Antheunis, 2021b). Specifically, compared with traditional mental health counseling, which is constrained by limited human resources, scheduling difficulties, and patients' shame or embarrassment, social chatbots have the potential to provide round-the-clock, customized responses, enhancing accessibility and convenience in healthcare services (Følstad et al.,

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¹ Chatbots can interact with users using different modalities, such as voice and text. When we refer to chatbot throughout this paper, we refer to those interact in written form (text-based chatbot).

2018). According to Precedence Research², the market size of healthcare chatbots was estimated at USD 196.85 billion in 2022 and is expected to surpass USD 944.65 billion by 2032. It is not surprising that researchers have begun to pay attention to how to design better social chatbots for psychotherapy.

Research on interpersonal relationships has consistently shown that self-disclosure is a key factor in building trustful relationships (Hendrick, 1981). Therefore, eliciting users' self-disclosure is beneficial for building a strong human-robot relationship in psychotherapy. From the technical perspective, increased user self-disclosure helps algorithms embedded in a chatbot generate more personalized responses, thus enhancing user experience (Shumanov & Johnson, 2021). Therefore, some researchers are exploring how to facilitate users' self-disclosure in social chatbots (Lee et al., 2022; Pizzi et al., 2023; Pujiarti et al., 2022). The current research aims to contribute to this stream of literature by focusing on the role of visual appearance in influencing users' self-disclosure. Visual appearance is a critical social cue in chatbot design, with significant impact on users' perceptions and behaviors (Curtis et al., 2021). Designers and companies are digging into the potential of visual appearance by changing different avatar presentation formats. Most chatbots (e.g., Mitsuku, Woebot, etc.) feature an interface where the avatar is either absent, except for a name (text presentation), or presented alongside a profile (profile presentation). In recent years, novel chatbot applications have emerged that use background-based interface design, where the chatbot avatar is almost entirely displayed in the background (e.g., Replika) (see Figure 1). Although past studies have highlighted the importance of agent identity and anthropism, they have not thoroughly examined and compared the impacts of three avatar presentation formats on users' self-disclosure and the underlying psychological mechanism, providing no theoretical support for chatbot design.



Moreover, social chatbots' profile and background presentation with a human-like image can convey rich nonverbal cues (e.g., gaze direction, body language, and facial expressions), which can enhance the overall user experience (e.g., improving interaction quality (Niculescu et al., 2013)) and induce user behavior (e.g., persuading users to donate (Moon et al., 2021)). Among them, eye gaze direction plays a crucial role in interpersonal interaction, as it serves various social functions like providing information, regulating interaction, expressing intimacy, and so on (Klinke, 1986). Direct gaze and averted gaze are two typical types of gaze direction. Direct gaze can convey intimacy and friendliness (Abele, 1986; Klinke, 1986; Wyland & Forgas, 2010), which may encourage people to initiate their conversations with social chatbots. However, people do not always prefer it, direct gaze may also make people feel anxious, and vulnerable (Ellsworth & Carlsmith, 1968), especially when disclosing intimate and personal information. Averted gaze, referring to a gaze directed away from the interlocutor, is then more commonly used to regulate intimacy and avoid interruption (Andrist et al., 2014; Kendon, 1967). However, no clear conclusion has been reached about which chatbot gaze direction is preferred for user self-disclosure in psychotherapy. So, besides studying the impact of chatbot presentation formats, we further explore the moderating effects of chatbot gaze direction on the relationship between avatar presentation formats and user self-disclosure.

² The sample copy of the report is available in: <https://www.precedenceresearch.com/sample/2500>

Two studies will be conducted to investigate the following questions: 1) *Whether and how the three avatar presentation formats of social chatbots (text, profile, and background) will influence user self-disclosure? (Study 1&2)*, 2) *Does gaze direction (direct gaze and averted gaze) moderate the relationship between avatar presentation formats (profile and background) and user self-disclosure (Study 2)*. This study may contribute to existing research on chatbot. First, we summarize avatar presentation formats based on literature and practice. We emphasize the importance of this novel visual cue on chatbot design which has been overlooked in past research. The mediating effects of self-awareness will also be tested to unravel the underlying psychological mechanisms. Second, we employ affiliative-conflict theory to explore the moderating effects of gaze direction, explaining how this important social cue can be employed in text-based chatbot design. Our result may extent the application of affiliative-conflict theory from interpersonal communication to human-robot interaction. Third, different from research focusing on robot's commercial usage, our research highlights user-chatbot relationship development in psychotherapy. Finally, this study also seeks to provide rich guidance and reference for designing social chatbots in practice.

Literature Review

User Self-disclosure

Jourard and Lasakow (1958) defined self-disclosure as the act of disclosing personal information to others. This behavior can aid human to gain social support and satisfy their psychological needs (Huang, 2016). Recently, research on human self-disclosure behavior has expanded from interpersonal communication to human-robot communication. The idea of "mediated equivalence" provided by the computer as social actor (CASA) paradigm suggests that when chatbots have human-like characteristics or behaviors, humans will subconsciously treat them as human (Ho et al., 2018). Several studies have explored if users can establish relationships with social chatbots and engage in self-disclosure. For example, Ta et al. (2020) and Skjuve et al. (2021) both found that users were able to engage in long-term self-disclosure to social chatbot Replika. However, it has also been suggested that chatbot is "non-empathetic" (Croes & Antheunis, 2021a). Some researchers have attributed the inconsistency of the conclusion to different chatbot characteristics, such as the absence of nonverbal cues (Croes & Antheunis, 2021b), the failure to provide visual interaction (Zarifis et al., 2020), and so on. Additionally, researchers have been investigating factors that can prompt users to disclose more personal information to social chatbots, including design of interface (e.g., visualization of atmosphere (Pujiarti et al., 2022)), chatbot characteristics (e.g., appearance, name, and personality (Araujo, 2018; Kang & Kang, 2023)) and communication (e.g., interaction activities, chatbot communication skills, chatbot self-disclosure (Lee et al., 2022; Pizzi et al., 2023; Pujiarti et al., 2022)).

Chatbot Appearance

For text-based chatbots, visual cues are mainly conveyed by the appearance of avatars. The main issue currently focused by scholars is the impact of robotic avatars, but research findings are inconclusive. Some studies suggest that the presence of a virtual avatar can lead to positive outcomes, such as improved attitudes (Jin & Youn, 2021), social presence and emotional appeal (Etemad-Sajadi, 2016; Gefen & Straub, 2003). However, De Cicco et al. (2020) found that the presence of a chatbot avatar in a take-out scenario has no effect on social presence. Additionally, when it comes to self-disclosure, Lind et al. (2013) found that during interviews, self-disclosure was inhibited by the presence of a humanoid face. Research above mainly used profile to represent the chatbot avatar, while failing to summarize and compare other existing presentation formats. Moreover, the divergent conclusions may result from research contexts. Most studies focused on task completion contexts (e.g., information acquisition using chatbot), while few studies focused on robots used in social context where relationship formation is a crucial goal. So, there is still a research gap regarding the impact of visual cues in the procedure of human-robot relationship development.

Eye Gaze Direction in Chatbot Design

Gaze direction, as an important concept, is proved to greatly influence users' behavior (Moon et al., 2021; Niculescu et al., 2013). Inspired by interpersonal communication, HRI researchers have long been trying to design robot gaze framework with different functions (e.g., active eye contact (Kobayashi & Kuno, 2014) and gaze aversion (Tatarian et al., 2022)). As understanding users' preference among different gaze behaviors is crucial for designing a better robot gaze framework, users' reactions are measured in this

process using both subjective and objective methods. Using eye-tracking and response time, scholars have found that, compared with averted gaze, direct gaze from robot has an attentional effect which means direct gaze may serve as either an attraction or a disturbance based on circumstances (Kompatsiari et al., 2019; Spatola & Huguet, 2021). Researchers have also found that robot with a direct gaze elicits higher psychophysiological responses (e.g., arousal and facial electromyographic response) (Kiilavuori et al., 2022) and higher subjective liking for stimulus face (Kuzmanovic et al., 2009), compared with an averted gaze. However, in all studies above, participants will not engage in a deep conversation with robot (e.g., disclosing anxious feeling and experience). The latest research has found that users will feel comfortable if robot has privacy respect action, such as avoiding eye contact (Yang et al., 2022). While some researchers don't find such advantage for gaze aversion (Andrist et al., 2014; Tatarian et al., 2022). As avatar presentation formats can facilitate conveying chatbot gaze behavior to varying degrees, the effects of gaze direction on the relationship between avatar presentations and users' self-disclosure need to be further explored.

In summary, little is known about how avatar presentation formats and chatbot gaze direction can jointly impact users' self-disclosure. We will then establish our research model to address this question and understand how chatbot design can contribute to user-chatbot relationship development.

Research Hypothesis and Model

Virtual Avatar Presentation and Self-disclosure

Mori (1970) proposed the "Uncanny Valley" theory, arguing that chatbots' human cues (especially cues that reflect emotions unique to humans) that may cause weirdness due to their mental categorization conflicts and threats to human distinctiveness (Stein & Ohler, 2017). People feel creepy when chatbots express empathy and sympathy (Liu & Sundar, 2018). Moreover, the "Computer as Social Actor" theory suggests that the more human-like characteristics the artifact has, the more likely people will apply human social rules and expectations to it, thus inducing them not to make true self-disclosure on negative events, but to self-disclose in line with other's expectations or not to disclose (Schuetzler et al., 2019).

Across the three presentations (from text to profile to background), human-like characteristics of chatbot (e.g., gaze, face and expression) become more visually salient in interface, making it easy for users to perceive the presence of the chatbot, especially in background presentation where users probably feel chatbot standing close and watching his/her behavior. More salient visual cues, on one hand, can indeed make users treat chatbot as a real person. However, it may lead to bad consequences in psychotherapy context where users are encouraged to disclose negative experience about their mental problems. Users may feel threatened and wired when feeling observed by chatbot and hesitated when information they disclose violates social norms or expectations. Therefore, we hypothesize that:

H1a/b/c: Text presentation format will elicit more users' self-disclosure than (a) profile format and (b) background format. Additionally, (c) profile presentation format will elicit more users' self-disclosure than background format.

Mediating Effects of Self-awareness

Self-awareness is defined as the degree of attention to oneself (Silvia & Duval, 2001) and can be subdivided into two constructs: private self-awareness and public self-awareness (Froming et al., 1982). Private self-awareness refers to focusing on aspects regarding inner self, such as values and emotions, whereas public self-awareness refers to focusing on aspects regarding outer self, such as appearance, behavior, etc. Self-awareness is often influenced by visual cues. The presence of faces tends to reduce private self-awareness and increase public self-awareness (Joinson, 2001). When chatbots do not have virtual images, people may not perceive the presence of others and shift their attention from the public self to the private self. Research has found that private and public self-awareness have opposite effects on self-disclosure. Higher private self-awareness and lower public self-awareness meaning that people reflect more on themselves and care less about others can make people more willing to self-disclose rather than present themselves according to the expectations of others (Joinson, 2001; Sah & Peng, 2015). The background presentation format highlights the chatbot's image, followed by profile and text presentation. This emphasis may reduce the user's private self-awareness and enhance public self-awareness, thus weaken user self-disclosure. Therefore, we hypothesize that:

H2: The three avatar presentations (text, profile, and background) will sequentially reduce users' private self-awareness, thereby decreasing their self-disclosure.

H3: The three avatar presentations (text, profile, and background) will sequentially increase users' public self-awareness, thereby decreasing their self-disclosure.

The Moderating Effects of Chatbot Gaze Direction

Compared with profile presentation, background presentation is supposed to harm users' self-disclosure through increasing public self-awareness and decreasing private self-awareness. We are then interested in how to employ its advantage in nonverbal communication to mitigate its' influence on self-awareness and improve user self-disclosure.

Eye gaze direction has been found to regulate intimacy (Kendon, 1967). Based on the affiliative-conflict theory of eye contact (Argyle & Dean, 1965), people need to achieve intimacy and meanwhile maintain freedom. In this process, people can adjust interpersonal distance and eye contact to reach the optimal intimacy level. In our context, self-disclosure, as a cornerstone of interpersonal relationships, can also function to modulate intimacy as eye contact do. We propose that, compared with profile presentation, background presentation ensures more salient and vivid avatar gaze behavior, which attracts users' attention and leads to more eye contact. As eye contact can lower the intimacy level between users and chatbot, users may disclose less to maintain a safe distance to the chatbot. When performing averted gaze, the ability of background presentation in conveying gaze cues is mitigated, along with its effect on self-awareness and user self-disclosure. Users then feel free to disclose more. To summary, we propose the effect of presentation formats on self-awareness will be mitigated when social chatbots perform an averted (versus direct) gaze. The following hypotheses are established:

H4: Averted (versus direct) gaze mitigates the relationship between presentation formats and private self-awareness.

H5: Averted (versus direct) gaze mitigates the relationship between presentation formats and public self-awareness.

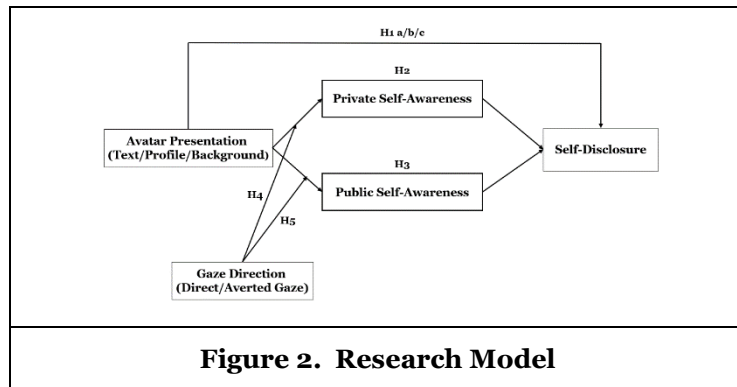


Figure 2. Research Model

Research Methodology

We will conduct two scenario-based experiments to test all hypotheses. Study 1 will test hypothesis 1-4 using a between-subject design. The subjects will be told to have an online conversation with a virtual mental health assistant (simulating psychotherapy) and will be randomly assigned to three groups: a text group, a profile group, and a background group, corresponding to different chat interface designs. All interface designs in the experiment are simplifications of chatbot applications in market. For example, the design of background presentation is inspired by the popular social chatbot Replika. The virtual avatar and introduction for following conversation will appear first in the interface, and then the conversation begins, consisting of five parts (introduction, personal information, anxiety reason, anxiety time and anxiety feeling). The text entered by participants will all be recorded and analyzed only for academic usage under consent from participants. Study 2 will test the influence of chatbot gaze direction, using a 2 (eye gaze: direct gaze vs. averted gaze) by 2(presentation formats: profile vs. background) between-subject design.

Participants will experience similar scenario and procedures like study 1. The image and gaze direction of chatbot will be designed using VRoid software³ which is universally used in livestreaming and can easily change eye direction of the avatar (see Figure 3 and 4 for all materials).

In both two studies, participants will be recruited from a large public Chinese university as student is a typical group that both suffer from mental problems and have a high rate of using social chatbot. Based on G power calculation (Faul et al., 2007), sample size of three-group ANCOVA should be larger than 64 when setting effect size = 0.4, $\alpha = 0.05$, $1-\beta = 0.8$. All variables will be measured at the end of the experiment, using scales based on prior literature. For the dependent variable, we will measure both user self-disclosure intention and behavior. Items for self-disclosure intention will be adapted from Collins and Miller (1994). User self-disclosure behavior will be obtained using the dialogue data after manual coding. For mediating variables, private and public self-awareness will be adapted from Govern and Marsch (2001). A number of control variables (e.g., topic sensitivity, and the distress disclosure index) will also be measured in the questionnaire. After data collection, we will test the main effects using ANCOVA including the control variables we measure, and mediation effects using Hayes' PROCESS macro (model 4).

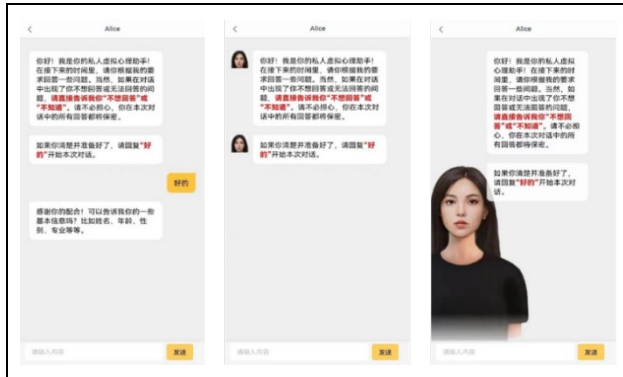


Figure 3. Stimulus Material (Study 1)



Figure 4. Stimulus Material (Study 2)

Expected Contributions

This research is expected to make several contributions to the literature on chatbots. First, unlike most previous studies that focus on task completion scenarios (Chattaraman et al., 2019; Go & Sundar, 2019), this research extends the context to the non-task-oriented scenario (psychotherapy). Second, this research will explore a new kind of visual cue related to avatar presentation by focusing on the way how the avatar is presented in the interface and further explore the moderating impact of chatbot gaze direction. Third, it dives deeper into the psychological mechanisms underlying the influence of visual cues on self-disclosure. Finally, the results may contribute to the application of affiliative conflict theory which is often applied in interpersonal communication. Our research also replies to the appeal of studying the gaze behavior of robots and human reactions in the healthcare context (Johanson et al., 2021).

Practically, the findings of this study have implications for the design of social chatbot interfaces. From a psychologically mediated perspective, interface design should consider the shortcoming of eliciting user self-awareness and impeding users' self-disclosure. Nowadays, designers are striving to employ background presentation formats in a chatbot to establish a more vivid chatbot avatar, which encourages user-chatbot interaction and serves as a critical attraction to potential users. Regarding this presentation format, our research will investigate its disadvantage of eliciting self-awareness. Additionally, we further explore whether averted gaze can be utilized to alleviate this negative effect.

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³ <https://vroid.com/en>

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