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A Study of Social Chatbots Affordances Mitigating Loneliness

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Research in Progress

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ABSTRACT

Loneliness is a significant concern and is linked to negative health outcomes such as depression and anxiety. Chatbots are gaining attention as potential companions to militate against loneliness. However, IS studies on the effects of human-AI relationships on mental wellness are limited, leaving unclear what enables humans to find companionship and intimate relationships with chatbots, and under what conditions human-chatbot interaction can alleviate loneliness. This study aims to develop a model of how chatbots alleviate loneliness and test it using a longitudinal study. Specifically, this research argues that shared identity affordance and social support affordance help mitigate loneliness directly and indirectly through enhanced intimacy feeling. The effects of chatbots' affordances on loneliness and intimacy depend on users' emotion regulation beliefs. Upon successful completion, this research has the potential to offer insight into the design of chatbots and how to leverage AI for social good.

Keywords

Social Chatbot, Affordances, Loneliness, Intimacy, Emotion Regulation

INTRODUCTION

Loneliness is a significant concern and is linked to negative health outcomes such as depression and anxiety. The COVID-19 pandemic exacerbated the "epidemic of loneliness" (Killeen, 1998; Kiron & Unruh, 2019) and has highlighted the significant impact of social isolation and loneliness on mental and physical health. To combat loneliness, people turn to social media, robotic pets, and artificial companions. For example, research has shown that robotic pets, such as PARO (Hung et al., 2019) and AIBO (Melson et al., 2009), can play the role of social partners and generate a similar sense of companionship as real pets. Along with advances in artificial intelligence and natural language processing, particularly since the release of ChatGPT, chatbots have become increasingly humanoid and are gaining attention as potential companions. During the global pandemic, the AI companion chatbots (i.e., Replika) saw a 35% increase in user registration and reached over 10 million users worldwide. Anecdotal evidence suggests that users find chatbots a significant source of help and comfort, especially when they are coping with grief, anxiety, loneliness, or depression.

Social chatbots and human-AI relationships also have received attention from academic researchers. For instance, the "computers are social actors" framework has been used to distinguish social and task-oriented chatbots (Chattaraman et al., 2019). Additionally, researchers have studied the "safe haven" (i.e., comfort, safety, and protection), "secure base" (i.e., emotionally, and physically available), and "proximity maintenance" (i.e., being the attachment figure under distress) features of chatbots (Pentina et al., 2023). Many people find companionship in chatbots and regard them as friends, mentors, or romantic partners (Skjuve et al., 2021). For people who have struggled with past experiences of rejection, chatbots provide a new relationship in which they do not fear being pushed away (Skjuve et al., 2021).

The studies mentioned above have contributed greatly to our understanding of chatbot use. Yet, IS studies on human-AI relationships and their effect on human mental wellness are limited. It is still unclear under what conditions human chatbot interaction mitigates loneliness rather than intensifies it and how chatbots afford humans to obtain companionship and intimate relationships with chatbots. Hence, to enrich our understanding of human-AI relationships in a healthcare context, this study attempts to address two research questions:

1. Under what conditions does human-social chatbot interaction mitigate loneliness?

2. How does human-social chatbot interaction mitigate loneliness?

To approach these questions, we develop a research model, drawing upon the affordance theory (Leonardi, 2013), and implicit theories of emotion (Tamir et al., 2007). The model distinguishes two types of chatbot affordances — i.e., shared identity affordance and social support affordance— and depicts how they influence users of loneliness directly and indirectly via chatbot-induced intimacy. Furthermore, the model argues that the influence

of chatbots on user loneliness is dependent upon the user's emotion regulation type (i.e., incremental emotion regulation or entity emotion regulation).

With the concerning surge in suicide rates and the escalating prevalence of mental health issues among young adults over the last ten years (Koulouri et al., 2022), coupled with the considerable adoption of emerging technologies by this demographic, this research will conduct a longitudinal study, using students from a major public university in the United States. Upon successful completion, this research has the potential to contribute to IS literature by (1) defining and categorizing novel chatbot affordances that help mitigate loneliness, (2) developing a research model that clarifies the mechanisms through which chatbots influence users' loneliness and intimacy feelings, and (3) exploring the moderating effect of emotion regulation beliefs on human chatbot interaction.

LITERATURE REVIEW AND BACKGROUND

Chatbot Affordances and Features

Affordances are "possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus & Silver, 2008, p. 622). They are a function of the user's goals and behaviors as well as the features of the technology (Leonardi, 2013). In this way, the material properties of the IT artifact (e.g., chatbot features) and the user with their abilities and goals together determine the affordance (Stoeckli et al., 2020). Researchers have identified different chatbot features from different perspectives. For instance, Ring et al. (2015) compared chatbot features for passive versus proactive interaction with humans. This study investigates how chatbot features may provide affordances for alleviating loneliness.

This study adopts the social provision framework (Cutrona & Russell, 1987; Weiss, 1974) to connect chatbot features with different affordances. This framework identified six social provisions of interpersonal relationships: reassurance of worth, social integration, attachment, opportunity for nurturance, guidance, and reliable alliance. Through these provisions, individuals feel supported and avoid loneliness, though the significance of each function varies across contexts and life stages (Weiss, 1975).

Reassurance of worth indicates the recognition of one's competence, skills, and values by others. Chatbot features, such as remembering details and using language like 'You did a great job' and 'I'm glad you just said that' enable the chatbot to recognize and affirm the user's worth. **Social integration** means a sense of belonging to a group that shares similar interests, concerns, and recreational activities. Chatbots that express interest in the user's enjoyed activities and mention that many others share similar interests can provide this sense of belonging. **Attachment** indicates emotional closeness from which one derives a sense of security. Chatbots that provide comforting, uplifting, and non-judgmental information and display empathy may induce emotional closeness, trust, and dependence in users. **Opportunity for nurturance** refers to the capability and chances of one being relied on by others. Chatbot features that initiate conversations and requests for care provide this opportunity. **Guidance**, in the context of human-chatbot interaction, refers to the advice and information provided by the chatbot. Reliable alliance refers to the assurance that others can be counted upon for tangible assistance. However, under human-chatbot interaction, users do not receive tangible assistance, so we do not include reliable alliances in our model.

In addition, we consider shared identity affordance because people can treat chatbots as having an identity, a feature that differentiates chatbots from other information and communication technologies (Haluza & Jungwirth, 2015; Young, 2018). We define shared identity affordance as *the degree to which the chatbot enables the users to assign the chatbot a social role and treat it as an independent being that shares a similar identity*. A sense of shared identity contributes to one's sense of belonging and has been associated with positive health and well-being outcomes (Greenaway et al., 2015). This shared identity was understood through things like facial expressions, team symbols, group actions, and common challenges (Neville & Reicher, 2011). We consider two major functions that support shared identity: personification and personalization. **Personification** enables the chatbot to employ human-like characteristics, reducing the perceived discrepancies between the user and the chatbot, and amplifying the user's identification with the chatbot. For instance, the inclusion of anthropomorphic features (e.g., a human-like voice) in a chatbot allows the user to build fondness for interacting with it. As a result, the user may develop a sense of appreciation and responsibility towards the chatbot and treat it as an independent being that shares a similar identity. **Personalization** can further enable users to configure the chatbot to adopt facial expressions and clothing styles that mirror those of their ingroup, serving as a symbolic representation. When users can tailor the chatbot's responses and appearance to match their interests and identity, more pertinent information and interactions are present. This heightened relevance fosters a stronger sense of belonging. We argue that chatbot affordances that help build a shared identity may reduce loneliness.

Based on the above discussion, we categorize chatbot features into seven functions, and match those functions with two affordances (i.e., shared identity affordance and social support affordance), as summarized in Table 1.

Chatbot Affordances	Chatbot Functions	Definition	Chatbot Features Examples
Social Support Affordance	Reassurance of Worth	The degree to which the chatbot recognizes and affirms the user's competence, skills, value, and	Remembering the conversation, using language such as 'You did a great job.' and 'I'm glad you just said that.'

		accomplishment, amplifies the user's self-esteem and elicits a positive self-evaluation.	(Skjuve et al., 2021; Svikhnushina et al., 2021; Ta et al., 2020)
	Social Integration	The degree to which the chatbot enables the user to feel a sense of belonging to a group that shares similar interests and concerns.	Acknowledging the user's interests and concerns, expressing interest in those activities, and mentioning that many others share similar interests.
	Attachment	The degree to which the chatbot recognizes the user's emotions, demonstrates empathy, and fosters trust and the user's willingness to be vulnerable.	Non-judgmental conversations, emojis, uplifting and comforting messages, a sense of humor, and 24/7 accessibility (Brandtzaeg et al., 2022; Pentina et al., 2023; Skjuve et al., 2021; Svikhnushina et al., 2021; Ta et al., 2020)
	Opportunity for Nurturance	The degree to which the chatbot empowers the user to feel dependable for their care, companionship, and interaction.	Conversation initiation (Brandtzaeg et al., 2022; Pentina et al., 2023; Skjuve et al., 2021; Svikhnushina et al., 2021; Ta et al., 2020)
	Guidance	The degree to which the chatbot offers advice, information, and educational insights on scientific activities.	Answering questions, providing news, music, and movie recommendations, and leading activities such as practicing breathing techniques (Pentina et al., 2023; Svikhnushina et al., 2021; Ta et al., 2020)
Shared Identity Affordance	Personification	The degree to which a chatbot enables the user to treat it as an independent being.	Natural response, anthropomorphic features, humanlike voice (Pentina et al., 2023; Skjuve et al., 2021; Svikhnushina et al., 2021; Ta et al., 2020)
	Personalization	The degree to which the chatbot can be tailored by the user based on the user's own preferences.	Various options for configuring the chatbot's avatar appearance, chat space settings, customized responses, and conversational style (Brandtzaeg et al., 2022; Pentina et al., 2023; Svikhnushina et al., 2021)

Table 1. Chatbot Affordances for Shared Identity and Social Support

Loneliness and Intimacy

Loneliness was defined as a "distressing feeling that accompanies the perception that one's social needs are not being met by the quantity or especially the quality of one's social relationships" (Hawkley & Cacioppo, 2010, p. 218). Loneliness has been categorized into social loneliness and emotional loneliness (Russell et al., 1984). Social loneliness comes "from the lack of a network of social relationships in which the person is part of a group of friends who share common interests and activities" and gives rise to feelings of marginality, boredom, and aimlessness (Russell et al., 1984, p. 1314). Also called physical loneliness, social loneliness often results from a person's perceived social isolation and lack of companionship. For instance, people in retirement or illness experience social loneliness because of losing companions. Emotional loneliness, on the other hand, "results from the lack of a close, intimate attachment to another person" and gives rise to feelings of emptiness and anxiety (Heinrich & Gullone, 2006; Russell et al., 1984, p. 1314). Emotional loneliness arises from a lack of emotional support. A person may experience loneliness when they are alone or when they are surrounded by people with whom the person has no intimate attachment (Odekerken-Schröder et al., 2020).

Loneliness is associated with a lack of intimate relationships (Ernst & Cacioppo, 1999). Intimacy means "to make the innermost known', sharing one's core, one's truth, one's heart, with another, and accepting and tolerating the core, the truth, of another" (Cassidy, 2001, p. 122). It entails close, personal, and emotional relations with another person (Bakken & Romig, 1992). A broader concept of intimacy is seen as emotional closeness and physical closeness in different contexts (Mattiasson & Hemberg, 1998). Physical closeness concerns bodily contact or sexuality, which is beyond the function of chatbots. In this research, we focus on emotional closeness and adopt the definition of intimacy as Timmerman (1991): a quality of a relationship in which the individuals have reciprocal feelings of trust and emotional closeness toward each other and can openly communicate thoughts and feelings with each other (i.e., self-disclosure).

Implicit Theories of Emotion

Individuals implicitly hold one of two kinds of beliefs about their emotion regulation, which have consequences for their ability to regulate them (Tamir et al., 2007). Individuals who are *entity theorists* believe emotions are fixed and that they cannot modify them. They, accordingly, have little incentive to try to modify their emotions by using cognitive reappraisal. Individuals who are *incremental theorists* believe emotions are malleable and are more likely to believe that they possess the ability to control their emotions. They, accordingly, tend to use more cognitive reappraisal to evaluate behaviors and situations

to regulate their emotions. Study has found emotion regulation styles as important correlates and predictors of loneliness and well-being (Gubler et al., 2021). Individuals with adaptive emotion regulation tend to use time more flexibly and actively seek social support in different ways. As we will see, this can have implications for their interactions with chatbots.

HYPOTHESIS AND RESEARCH MODEL

Chatbot Affordances and Loneliness

We believe that chatbots as empathetic companions have the potential to mitigate loneliness. Prior research suggests that people feel less lonely if they get acquainted with their negative emotions and traits (Younger, 1995), or have empathetic companions (Killeen, 1998). On the one hand, chatbot social support affordance enables the user to get support that boosts one's self-esteem, improves emotions, and enhances the feeling of being cared for and understood. Besides, having a comforting and encouraging chat with chatbots enables the user to gain self-esteem. Getting guidance on social skills can also make the user more confident in human-human interactions (Skjuve et al., 2021). This indirectly enables the user to feel that they belong to a group, which helps reduce loneliness. On the other hand, shared identity affordance enables the user to assign a social identity to it and establish a connection with the chatbot. This connection and interaction will release the isolated feeling of the user and mitigate loneliness.

H1: Both perceived (a) shared identity affordance and (b) social support affordance of chatbots are negatively associated with loneliness.

Chatbot Affordances and Intimacy

Intimacy is a dynamic and context-dependent phenomenon (Rodgers, 1989). It develops through repeated interactions over time (Laurenceau et al., 1998). The intimacy process model (Reis, 2018) emphasizes the importance of both self-disclosure and partner disclosure in building intimacy. A chatbot designed with social support affordance can provide the user with positive feedback (i.e., reassurance of worth) and a sense of emotional safety and security (i.e., attachment), which may make them feel comfortable with sharing personal information and expressing their emotions, which is an essential component for intimacy development. The feeling and reciprocity of trust and social needs are also important for intimacy development (Mattiasson & Hemberg, 1998; Timmerman, 1991). Moreover, when allowing personalization and personification (features that support shared identity affordance), a chatbot can consider the user's preferences, interests, and personality, and make the user feel a stronger connection to the chatbot. A stronger connection may lead to increased self-disclosure from the user, which is important for intimacy. Additionally, a highly personified chatbot may also evoke familiarity and social presence, leading to a sense of intimacy. Hence, we hypothesize that

H2: Both perceived (a) shared identity affordance and (b) social support affordance of chatbots are positively associated with chatbot-induced intimacy.

Chatbot-Induced Intimacy and Loneliness

Research has shown that loneliness can be a reaction to the absence of intimate relationships (Ernst & Cacioppo, 1999). Without intimacy, people are "more hesitant to approach others and to disclose their problem for fear of being rejected and derogated" (Leung, 2002, p. 241). Intimate connections often require effective communication, trust, and the ability to share one's thoughts and feelings openly. By improving their social skills, individuals can better navigate the complexities of relationships, leading to deeper and more intimate connections with others which help alleviate feelings of loneliness (Mellor et al., 2008). Overall, intimacy and loneliness are closely intertwined in interpersonal relationships, and we believe it also applies to human-chatbot interactions.

H3: Chatbot-induced intimacy is negatively associated with loneliness.

The Moderating Effect of Emotion Regulation Beliefs

People who hold entity beliefs about emotion regulation (i.e., entity theorists) believe that emotions are fixed and that they cannot modify them (Tamir et al., 2007). They are likely to perceive less support from chatbot affordances, which reduces the impact of chatbot affordances on loneliness. On the other hand, people who hold incremental beliefs about emotion regulation (i.e., incremental theorists) believe emotions are malleable. As a result, they will be more adaptive to human-chatbot interaction and be more responsive to the support from chatbot affordances, which amplifies the impact of chatbot affordances on loneliness. For example, when a chatbot asks a person why they feel lonely and suggests hanging out with friends, people with incremental beliefs may view the chatbot's response as an attempt to help enhance their emotions and accordingly disclose more about their situation. In contrast, people with entity beliefs may view the chatbot as pointless and a waste of time. These different appraisals can result in different emotional responses and subsequent actions. Similarly, incremental beliefs of emotion regulation allow individuals to openly express their feelings and emotions, better understand and empathize with their partner's emotions, and engage in positive interactions and expressions of affection. The mutual understanding and positive interactions reinforce the emotional bond between partners, contributing to increased intimacy.

H4: The impact of chatbot affordances on loneliness will be stronger for those with incremental beliefs than those with entity beliefs about emotion regulation.

H5: The impact of chatbot affordances on intimacy will be stronger for those with incremental beliefs than those with entity beliefs about emotion regulation.

Figure 1 shows the research model.

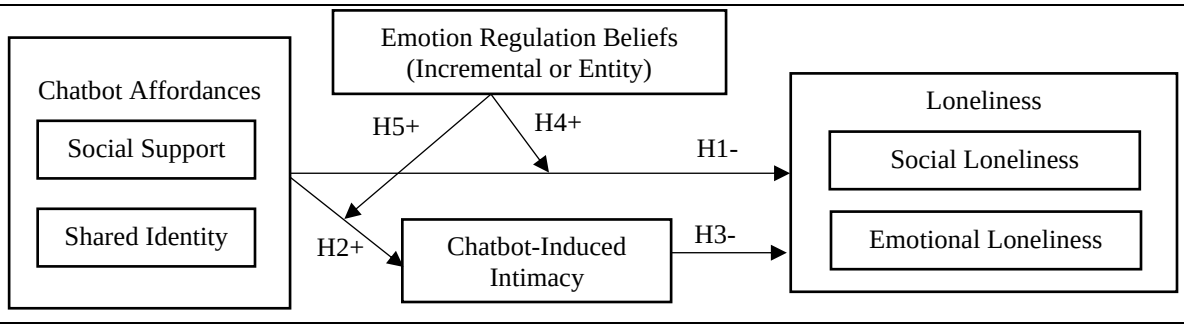

Figure 1. The Research Model

METHODS

We plan to conduct a field experiment using three different versions of a chatbot. The first chatbot holds shared identity affordance only and enables the user to personalize the chatbot (e.g., change its appearance, race, gender, and other identity attributes) and manipulate its personification (e.g., robot vs. human voice). The second chatbot holds social support affordance only, such as responding with supportive information (e.g., recommending books or movies, and proactively asking questions) and comforting emotions (e.g., using emojis, jokes, and humor) (Schanke et al., 2021). The third chatbot will hold both shared identity and social support affordance. Such a design allows us to test both the separate and interaction effects of shared identity and social support affordances.

We will conduct a longitudinal study over one month and collect data at 2 points in time. This longitudinal research design enables the study to prospectively analyze how various chatbot affordances influence the loneliness and intimacy of the participants over an extended period (Cutrona et al., 1986; Gilbey et al., 2007). At Time 1, participants will be randomly assigned to use one of the three versions of the chatbot and complete an onboarding questionnaire, which measures their initial perceived chatbot affordances, loneliness level, emotion theorist type, and demographic information. One month later (Time 2), the subject will be asked to answer questions about perceived chatbot affordances, perceived intimacy, and loneliness. They will also self-report their use (e.g., frequency and duration) of the chatbot. Table 2 summarizes the measures for each construct.

Research suggests that loneliness peaks during adolescence and young adulthood (Larose et al., 2002; Pittman & Reich, 2016). Accordingly, we plan to recruit college students from a major publication university in the United States to participate in the experiment. The study will control for variables such as family member visits and social media usage, which are known to be associated with loneliness (Berg-Weger & Morley, 2020; Pittman & Reich, 2016).

Construct	Measures (Sample Items)	Adapted
Loneliness	I feel in tune with the people around me. I can find companionship when I want it.	(Russell et al., 1980)
- Social Loneliness	I am not belonging to a group or social network that provides a feeling of belonging based on shared concerns, work, or other activities.	(Russell et al., 1984)
- Emotional Loneliness	I lack an intense, relatively enduring relationship, which provides feelings of affection and security, with one other person.	(Russell et al., 1984)
Chatbot-Induced Intimacy	I would feel comfortable telling the chatbot things that I do not tell other people; I have held back my feelings in other relationships.	(Hook et al., 2003)
Emotion Regulation Beliefs	Everyone can learn to control their emotions. People have very little control over their emotions (reversed)	(Tamir et al., 2007)
Perceived Shared Identity Affordance	I feel the chatbot enables me to establish a connection with it. The chatbot enables me to have a sense of "we-ness" with it. The chatbot enables me to share the same identity with it.	(Hinds & Mortensen, 2005; Hopkins et al., 2016)
Perceived Social Support Affordance	The chatbot makes me feel I can turn to it for guidance in times of stress; The chatbot makes me feel it enjoys the same social activities I do; The chatbot makes me feel someone needs me to care for them;	(Cutrona & Russell, 1987)
Control variables	Frequency of family member visits, students' offline friendship level (e.g., number of best friends), social media usage, and personality.	(Berg-Weger & Morley, 2020; Pittman & Reich, 2016).

Table 2. Constructs, Measurement Scales, and Sample Items

As we have developed measures to operationalize the perceived chatbot affordances and modified existing scales to assess other constructs, we will assess the content validity of the constructs following the approach of MacKenzie et al. (2011). Once data are collected, we will test the research model using a covariance-based structural equation modeling tool such as STATA. To illustrate the moderation effects, we will calculate simple slopes following the method described by Aiken et al. (1991).

POTENTIAL CONTRIBUTIONS

Upon successful completion, this research will offer three key contributions. First, we offer a systematic understanding of chatbot features that can induce an experience of human-chatbot intimacy and mitigate loneliness. We defined two novel chatbot affordances – for shared identity and social support – associated with seven designed functions and developed instruments to assess perceptions of those affordances. Second, we offer a novel research model, which, if confirmed by the empirical study, can depict how chatbot affordances influence loneliness both directly and indirectly via human-chatbot intimacy. Additionally, we extend the theoretical repertoire of the IS literature on human-chatbot interaction by incorporating implicit theories of emotion that may affect an individual's appraisal of the interaction. Third, the results of our empirical study could offer critical insights into how chatbots may be designed to alleviate loneliness, thereby informing the mental healthcare literature by introducing social chatbots as a mental health alternative in the face of shortages of mental health professionals and individual fears of stigma associated with seeking assistance for mental health issues.

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