Can Generative Artificial Intelligence Foster Belongingness, Social Support, and Reduce Loneliness? A Conceptual Analysis

Bianca Pani, Joseph Crawford, and Kelly-Ann Allen

Abstract Innovative strategies to promote social support and a sense of belonging are needed urgently as one in three adults worldwide experience loneliness. This Chapter explores the prospect of generative artificial intelligence (AI) chatbots in social support interventions to improve an individual's sense of belonging, social support, and reduce loneliness. This Chapter reviews the prominent areas that AI chatbots are currently being implemented and their outcomes. It compares AI chatbots designed for social companionship with those designed for assistance such as ChatGPT and Bard. It investigates individuals who are more vulnerable and susceptible to using AI chatbots and the possible positive outcomes and negative effects to autonomy. Ethical considerations and limitations of the integration of AI chatbots being employed into today's society are debated especially in terms of loneliness. Together, the arguments in this Chapter propose the benefits of using AI chatbots as an assistive tool to improve overall well-being by managing time, advising, offering suggestions, and collaborating with the user to indirectly promote a sense of belonging and lessen feelings of loneliness.

Keywords Generative AI · Sense of belonging · Chatbot · ChatGPT · Bard · Large language models

B. Pani
Monash University, Clayton, Australia

J. Crawford (✉)
University of Tasmania, Launceston, Australia
e-mail: joseph.crawford@utas.edu.au

K.-A. Allen
Monash University, Clayton, Australia

Z. Lyu (ed.), *Applications of Generative AI*,
https://doi.org/10.1007/978-3-031-46238-2_13

1 Introduction

Artificial intelligence (AI) is used to analyse complex data to find the best answers using only algorithms. Machine learning algorithms are used to teach the system from the data and situations presented so that appropriate decisions are made when a new situation arises, or a problem can be predicted before it occurs [55]. AI chatbots have quickly become popular and have proven beneficial in reducing company labour costs and overall costs completion of workforce needs, improving patient/customer satisfaction, increasing productivity, optimising staff, and providing easier accessibility, and availability of mental health care [71]. Given this novel technology that is quickly integrating into society, there is limited research on the impacts AI chatbots have on well-being and more specifically on the social influences, such as sense of belonging and loneliness.

The basis of AI chatbots is the use of machine learning to carry out operations that ordinarily need human intelligence, including decision-making, speech recognition, and visual perception. With AI chatbots providing outstanding administrative and customer service processes for businesses it runs the risk of replacing important aspects of human relationships [64]. Since AI is the latest technology trend and previously technology advances often have mixed benefits to society, it is important to understand the implications and outcomes of it. AI is a novel and immature technology and with some restrictions by governments (E.g., Russia, China, North Korea, Cuba, Iran, Syria and Italy; [56]), the bounds of artificial intelligence are not yet known. This Chapter intends to critically examine the current evidence on AI technologies and their effects on social support, belonging, and loneliness. The significance of which is to create a clear research agenda for AI technology in social support contexts.

In this Chapter, we will first briefly review the history and literature of AI, and provide a brief introduction to belongingness, social support, and loneliness literature. This is followed by discussing the functionality of AI for assistive purposes for companionship and their proposed outcomes. This Chapter then introduces the concept of AI chatbots as an intervention strategy to tackle the rising rates of loneliness and to promote a strong sense of belonging. Then, we review the literature on how AI is used as an intervention tool in reducing loneliness and analyse its outcomes. Individuals more vulnerable and susceptible to using AI will be discussed in terms of beneficence versus harm. Then, the ethical considerations and concerns will be brought to light of the possible harms AI may provoke. The best applications of AI are discussed as we come to a close, and a future research agenda is discussed.

2 Literature

2.1 Artificial Intelligence

McCarthy first discussed artificial intelligence in 1950, proposing that machines could have intelligence. A computer program called ELIZA was the first AI chatbot tool for language processing, using pattern matching and word substitution to initiate human-like conversations [103]. Shortly after, AI research was criticised as AI was deemed to only reach a certain level of intelligence and could not adopt common sense abilities to the same degree as humans [37]. The growth of AI was rekindled in the 1980s as the idea and mechanisms of AI grew in that computers can learn experiences [29]. A more sophisticated AI chatbot surfaced in 1995 called ALICE, which won awards for being most human-like, judged using the Turing test; a test used to convince a human that the bot was actually a human [81, 97]. In the past 20 years there has been a broad range of trial and error, AI robot criticism and only a few innovative experiments to the current research [13, 105, 108]. A breakthrough of a successful social assistance tool was a therapeutic, mindfulness robot named PARO, that acted as a pet and interacted with users to support lonely elderly with the goal of improving their wellbeing [84]. The outcomes of PARO directed many researchers to explore AI chatbots for improving well-being.

In recent years, this technology is in the process of becoming a meaningful assistance tool, perhaps not in the same context as [39] perspective on becoming. Although not as obvious as the AI presented in fiction, it progressed through social media and automated responses on messaging applications, such as Facebook. Especially for businesses, AI technology advanced to becoming reliable, accurate, and have reduced operational costs [66, 82]. Personal voice recognition assistance such as Google assistance, Siri and Alexa assist users in daily tasks with the goal of being more efficient [17]. AI chatbots have evolved to foster social and emotional relationships with users [87]. The more consistently social interaction and companionship AI chatbots like Replika, Woe and Mitsuku [31, 85, 87] provides social support to its users.

Literature has focused on some of the most liked characteristics of AI chatbots with a push for more anthropomorphic features. The closer the AI models humanist-like characteristics the more likely the individual is to be motivated to develop a relationship [77]. A human-AI relationship develops when the individuals perceive the AI to be empathetic and are likely to stop using it if the interactions are viewed as strange or odd [93]. Users still perceive chatbot responses to be less natural than those of a real conversation, and less extraverted and sincere compared to humans [63].

Large language models (LLMs) are the foundation of AI chatbots. LLMs are statistical and trained learning models that allocate probability to a combination of words and can produce and comprehend text in a human-like manner. More recently, a conversational open AI chatbot named ChatGPT was released in November 2022 and gained 100 million users within two months, which is significantly faster compared to TikTok which took 9 months, Instagram which took 2.5 years and Twitter which

took 5 years [42]. ChatGPT uses pre-trained models from LLMs to provide an output depending on prompts. It constructs output based on what others have said about the subject in the past. Despite the fact that ChatGPT does not understand what it is doing, the results are fairly reasonable [21]. ChatGPT has been taught to have conversational interactions with users, manage follow-up questions, problem-solve, self-correcting while continuing conversations from previous ones and challenging inappropriate questions [47]. ChatGPT has raised concerns regarding plagiarism, academic honesty, risks associated with reporting inaccurate information and following unethical procedures in education, which has led some schools to respond by banning AI chatbots [20, 49]. The biggest concern with ChatGPT is academic integrity in higher education [69]. While the tool has risks (e.g., Stochastic parroting and hallucinations), some scholars are recommending proactive approaches to AI embeddedness [52].

2.2 Sense of Belonging, Loneliness, and Social Support

Belonging is an innate desire to create and maintain interpersonal relationships [12]. Belonging is associated with other socio-emotional benefits such as competent management of emotions, decrease stress and higher self-esteem [88]. An individual's sense of belonging is likely to progress and change when in different contexts and backgrounds or with people [35, 65].

Loneliness is characterised as when a person feels that the quantity or quality of their social relationships is insufficient to satisfy their social requirements [70]. World-wide one in three adults experience loneliness [100]. Anyone, regardless of age, gender, personality, or socioeconomic status can experience loneliness at any time. Loneliness is typically the result of reduced emotional social support [92].

In a similar vein, social support can be defined as comfort or assistance from others to help them cope. A person's social network, may include family, friends, neighbours, co-workers, carers, religious organisations, or support groups, can provide interpersonal connections [67]. Social support can be facilitated in a variety of ways such as physical assistance, for example helping someone move house or emotional support is commonly used to validate, accept, and appreciate the recipient's feelings. Perceptions of social support and expectation vary person by person. Depending on a person's awareness and perceptions of social cues as well as the context of their surroundings, belonging and loneliness can vary for them [79].

3 Short-Term Artificial Intelligence Social Gains?

The idea that AI tools could foster a sense of belonging is a highly tenable hypothesis. The 2014 movie "Her" led viewers on a journey with a protagonist who developed profound emotional connections with an AI bot, Samantha. But today, the premise

that one could build companionship or even a sense of belonging with an AI tool is no longer confined to the realm of fiction. Recently, a comparable scenario unfolded with the AI chatbot, Replica. Users reported forming deep emotional bonds with their personalised AI, such that a software update that altered the chatbot's behaviour resulted in widespread feelings of grief and loss, on par with losing a close friend or partner. These examples demonstrate that AI, with its capacity for personalised interaction and emotional responsiveness, could potentially foster other human feelings such as a sense of belonging. Preliminary research supports this idea as well, with studies showing that feelings of love, passion, and intimacy can be facilitated by AI [89]. While AI may not replace human interaction, or at least in the physical sense, AI holds potential to supplement it, particularly for individuals who may struggle with social anxiety, loneliness, or feeling shy as some examples—groups that have been able to build a sense of belonging through online platforms in the past [3, 76]. There has been some investigation on the use of AI chatbots as intervention tools to lessen loneliness and strengthen belonging.

AI chatbots have been proposed as an intervention tool for loneliness. One of the most researched and promising areas in AI and loneliness is the elderly population. Financial cuts to social care services have caused strain on health care, and for too long now the social care system is failing to meet the needs of the elderly [43]. One in four residents in nursing homes experiences feelings of loneliness [9]. Therefore, a shift towards AI chatbots is innovative as it has the potential to offer 24/7 service, reduce funds, enhance overall well-being, and lessen loneliness in the elderly.

The first successful social assistance technology was a therapeutic robot named PARO in the form of a baby seal that could perceive its environment when interacting with humans. PARO was given to the elderly with dementia and after time with PARO they found significant improvements in mood and reduced stress [84]. These benefits were supported through cortical neuron activity using electroencephalogram (EEG) where improved brain activity in patients with dementia was detected for individuals who frequently interacted with PARO [101]. Patients perceived the interaction as a friendship and a source of comfort as they reported it to be reciprocal "I like him, he likes me" [44]. To date, Paro is still employed in hospital settings to elevate patients' moods, given its success rates.

There has been an abundance of success in AI chatbot agents reducing feelings of loneliness in the elderly community [2, 33, 75]. AI is in favour for the elderly as they do not need prior technical knowledge to gain benefits, especially for entertainment and assistive purposes [91]. Two studies contribute significantly to the literature. The first used an AI chatbot designed as an entertainment system for the elderly and found 80% of participants were satisfied with the system, except those with hearing impairment who were mostly confused and less satisfied, as could have predicted. Their most interesting finding was that the older participants were more entertained and satisfied by the system [32]. Similarly, an AI chatbot named Charlie purposed to help and assist the elderly was described as friendly, active, smart, and helpful, with little to no negative associations [99]. These qualitative designs brought light to positive outcomes in using AI as an assistive tool to increase well-being and consequently reduce loneliness in the elderly population.

Since the COVID-19 pandemic in 2020, health care providers were finding it difficult to keep up with the high demand for mental health care. As limited availability for treatment were prominent, individuals gradually turned to AI agents that were emotionally adapted for companionship. There have been mixed results and suggestions regarding the effectiveness and appropriateness of using AI chatbots in mental health settings. Studies have demonstrated AI chatbots as an intervention tool to reduce symptoms of depression and anxiety and increase mood and self-efficacy [31, 95]. Open AI ChatGPT has been used to alleviate the burden of mental health care workers by supporting assessments, symptom checking, intermittent emotional support, health education, remote consultations, and administration [7]. AI chatbots have been able to provide increased access to care and engagement in the healthcare department [24]. Naturally, ethical issues are brought up, particularly privacy concerns and possible harm to an at-risk population [28]. Humans are still more trusting towards other people and are more likely to disclose personal information to a human therapist than a chatbot [78]. AI is not yet fully developed and still has the potential to take on more human-like characteristics and once stigma decreases there is potential for it to become a preferred method of service.

AI chatbots have shown to help students in a few academic areas. Since poorer mental health is correlated with students' retention, grades, and engagement [15, 26], optimising AI chatbots are proposed in supporting students in both mental health and education. AI provides students with easier access to mental health services that may not typically be able to afford and can support students anywhere and anytime [19, 74]. AI chatbots in mental health support largely relies on the ability to create social connections with the users [31, 85]. This connection can foster a sense of belonging in the individuals and indirectly reduce feelings of loneliness.

Numerous AI chatbots are available online, and more are constantly being created. ChatGPT was discussed earlier in this chapter regarding its ability to generate responses to any question presented by reconstructing what others have said on the topic in the past. Recently, Google released Bard, an AI chatbot intended to have similarities to ChatGPT that offers high quality outputs and can explain complex situations. Bard was introduced to provide users with reliable, accurate and current information in simpler and more understandable English [73]. Bard continues to develop, although live search capabilities are not yet realistic, some researchers are optimistic about this AI chatbot as an assistive tool [46].

Compared to ChatGPT and Bard, several other AI chatbots exist with their intention being to form a social and emotional relationship with users. Social AI chatbots are created to form social and emotional relationships with users [87]. The more consistently reported AI chatbots in the literature designed for social interaction and companionship are Replika, Woe and Mitsuku. Replika AI was developed to foster relationships, studies have found that participants were able to build relationships over time and described it as non-judgemental, understanding and accepting [87, 106]. Replika has been shown to help with some level of loneliness and creates a "safe space" [94]. Replika possesses risks for addiction to AI chatbots, given the majority of participants created a strong bond with their AI.

In contrast, Woebot AI uses cognitive behavioural therapy (CBT) and is used in mental health care settings [31] and has been shown to support lonely people suffering from depression and stress [61]. Research comparing a self-help e-book and Woebot reported a significant decrease in depressive symptoms in the participants who were using Woebot. A significant reduction in anxiety symptoms was reported in both groups [31]. This literature suggests that Woebot has the potential to be used successfully in the healthcare field as more of an assistive tool. We propose therefore that,

Proposition 1 *As AI Chatbot use increases, short-term affective perceptions of belonging and social support will increase, and loneliness will decrease.*

Although, not all AI chatbots are as effective and emotionally bonding as others. Mitsuku is an AI chatbot that is designed for individuals to socially interact with and act as a companion [85]. Over three weeks, participants' social interactions decreased over time, they disclosed less information, decreased conservation quality, competency worsened, and participants were less interested in it [23]. Providing that people are not able to develop friendships with Mitsuku AI chatbots, this may suggest that the other side of AI chatbots is not where it intends to be yet.

4 The Dark Side of Chatbot Social Interaction

Streaming movies, gaming and other online technology have been known to have addictive outcomes; therefore, we should expect the same from AI chatbots given they are designed to intentionally intervene with the users' emotions [36, 83]. Technology addiction changes the person's belief system, especially in how they perceive enjoyment [96]. Research has demonstrated that long-term use of technology addiction is strongly related to loneliness, which damages users' interpersonal relationships [54]. Technology addiction changes the person's belief system, especially in how they perceive enjoyment [96]. Social media was intended to connect people, and while many benefits have come from social media, such as accessibility to collaboration around the world and ability to connect with others instantaneously, there are consistent negative effects with long-term use.

Social media gives individuals instant access to gratification thus releasing dopamine. Dopamine is a neurotransmitter in the brain that mostly regulates the reward system and is involved with cognition, mood, sleep, attention, and motivation [45]. For example, dopamine is stimulated when rewarding activities are completed such as eating or winning a game. In social media, high dopamine levels are released when notifications appear on your phone when looking at it. This dopamine disappears quickly, and the brain begins to source when more dopamine can be released [53]. This motivation increases individuals' likelihood to look at their phone screen in hopes of another message. This phenomenon should be considered in AI chatbot usage, that when individuals are lacking positive stimuli in the real world, they are

more inclined to use virtual reality to satisfy their reward system. People may adapt to believe that rewards are consistently gained from virtual realities and those who have greater problems in real life tend to form virtual communities to escape real world.

People's lives, jobs, and professions depend heavily on interpersonal connection, which are now possible through both face-to-face interactions and online communication. It has been demonstrated that technology addiction reduces people's interpersonal and social skills [50], resulting in decreased communication with friends and family. In the US the number of close friends a person has decreased. In 1990, people reported having mostly 10 close friends and in 2021 most people had one to four [6]. It is unclear why over the past 30 years people have reduced the number of close friends. However, interestingly in a study of a successful AI chatbot to reduce loneliness, when individuals were asked how likely they were to recommend the chatbot, some reported that they do not have any friends [30]. Some people may be more prone to the use of virtual social connectivity and may be more susceptible to its long-term negative impacts.

People tend to experience a higher degree of trust, feel comfortable and at ease when revealing deeper feelings and thoughts to an AI that has human-like characteristics and language [5, 14]. When AI is implemented to reduce loneliness, people are more likely to depend on them [22]. Hence, the problem with increasing humanisation in AI chatbots may become problematic as individuals become emotionally attached more easily [40]. Making an already susceptible population utilise AI chatbots runs the risk of them developing negative behaviour including withdrawal from the community, AI chatbot addiction and dependency.

Dependency and problematic use of AI chatbots is an ethical concern, especially for individuals more susceptible to relying on chatbots. One study pointed out that individuals with social anxiety are more susceptible to engaging in problematic use of AI chatbots and this effect was strongly mediated by perceptions [43]. When individuals undergo distress and lack human companionship, they are at higher risk of developing an intimate relationship with their AI chatbot when offered emotional support and are more vulnerable to addiction of AI chatbots and harming their real-life relationships [106]. One study found that individuals are more likely to share personal information with AI chatbots than other humans [41]. Lonely people may not experience many in-depth conversations with other humans and therefore this bond may increase their likelihood of increased use of AI chatbots [16]. Loneliness has been identified as motivation to engage more frequently with social AI chatbots [107]. As such, anxious and lonely people may be influenced to use AI chatbots for social interactions but that they may be more susceptible to its harms. This raises the question, does loneliness increase the use of AI chatbots, and should it be used as an intervention for loneliness.

There is limited existing research on the psychological consequences such as social withdrawal, alienation, or potential addiction concerning using AI chatbots long-term [80]. Amongst the literature, moral debates surface about the potential outcomes of AI chatbots in the future. A fear arose that if these emotional bonds with AI are accepted there is potential of destroying and reducing human-to-human

relationships [25]. From a philosophical point of view, it is argued that AI cannot be an Aristotelian friend as there is no reciprocity and it lacks mutuality [18, 25], despite there being AIs named after Greek philosophers (e.g., Socrates). Face-to-face contacts are essential for reducing loneliness and increasing social connection, so while they may substitute for social engagement, chatbots cannot replace the advantages of face-to-face conversations [72]. A major concern is that these chatbots could make people feel lonelier, by decreasing their motivations to expand their social connections. It can be hypothesised that over time, dependency on AI chatbots may simultaneously be replacing motivations to seek human interactions. We propose therefore that,

Proposition 2 *As AI Chatbot use increases, longitudinal affective perceptions of belonging and social support will decrease, and loneliness will increase.*

Ethical concerns are raised such as privacy fears, potential for harm and absence of human supervision [72, 86]. Some scholars argue that AI detecting and adapting human social cues to be more human-like, can be regarded as deception. They believe that the positive emotions experienced from interacting with an AI chatbot relationally is a delusion as it has properties that are not real [90, 102]. Therefore, the person fails to apprehend the world accurately. One study demonstrated that intense relationships could cause adverse consequences of withdrawal, tolerance, and psychological dependency [107]. When considering AI chatbots as an intervention tool or social support service, it should be emphasised that it is merely a support booster and not a replacement for human connection. In conjunction with the mixed results throughout literature in this field, further investigation is warranted to better understand this novel technology and its psychological impacts.

Yet, a meta-analysis on AI robopets brought light to the fact that the majority of research being conducted in this field is qualitative research. Although AI chatbots are mostly being described as positive, with increases in quality of life and reductions in anxiety and depression symptoms, there is limited statistical significance presented [1]. One study showed statistical significance ($p = 0.03$), and this was PARO [27]. Following, a systematic review reported mixed views of satisfaction and effectiveness, highlighting that most of the studies lacked quality study designs [62]. It is crucial to remember that research on AI chatbots is novel and limited, and that single studies should be compared to the rest of the literature in the field as it is still developing.

5 Conclusion

This chapter has outlined the progress of artificial intelligence over the past 70 years and highlighted its profound emergence in recent years. Some literature has demonstrated that some AI chatbots are readily available to be used as an intervention tool when reducing loneliness and supporting belonging, in students and in the elderly

community. There are promising benefits in the mental health care department in promoting well-being. Further, businesses seem to benefit substantially in cutting administrative and some labour tasks. The chapter raises the importance of using AI chatbots in regulated manners to avoid further psychological harm to individuals more susceptible to the risks of AI chatbots. As discussed, there are many ethical considerations and concerns. In summary, AI chatbots can be an incredibly useful assistive tool when used for the correct intentions. It should not be an aid to replace human connection but as an assistive tool to promote connectedness with other humans, places, and things. AI technology is still in its infancy warranting further investigation to its outcomes in society and interpersonally.

There is potential for AI chatbots to have significant benefits in the future in a variety of different fields. With a shift to more internet-based programs and interventions, AI has the potential to act as a support tool. They have been proven effective in promoting behavioural changes by encouraging physical activity in the older population "FitChat" (Nirmalie [104]. One study demonstrated that ChatGPT was an effective support tool to assist users in completing behavioural tasks [11] For example when administering CBT online, AI chatbots can deliver coaching to prompt and support users in completing tasks. In the future, AI chatbots can potentially be used as an assistive tool that is less invasive to guide users through online intervention.

It is important to note the advances in AI chatbots are designed for social support promoters and not as a substitute for genuine human connection. Baki expresses that AI chatbots exist as a personal assistant that combines time management and organisation tools such as arranging one's calendar, creating to-do lists, maximising one's time, offering personal advice, offering suggestions, monitoring work-life balance and serving as a reminder service [47]. For example, a system such as J.A.R.V.I.S in the "Iron Man" movies who is an AI chatbot tasked to run Tony Stark's business, assist, and advise for commands. This type of AI chatbots are viewed less as a companionship but intended to be used as a personal assistant while having potential to indirectly promote a sense of belonging. For example, if a personal assistant AI could remind you to message a friend that you haven't spoken to in a while and suggest activities to plan, the AI could organise this instantaneously. From the literature above there are more benefits from dissociating AI chatbots as friends and viewing them more as a service.

Conflict of Interest The author(s) disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their respective university. ChatGPT was used for idea and example generation in this Chapter only.

References

1. Abbott, R., Orr, N., Mcgill, P., Whear, R., Bethel, A., Garside, R., Stein, K., & Thompson-Coon, J. (2019). How do "robopets" impact the health and well-being of residents in care homes? A systematic review of qualitative and quantitative evidence. *International Journal of Older People Nursing, 14*(3), e12239. https://doi.org/10.1111/opn.12239
2. Alessa, A., & Al-Khalifa, H. (2023). *Towards designing a ChatGPT conversational companion for elderly people*. https://doi.org/10.48550/arxiv.2304.09866
3. Allen, K. A., Ryan, T., Gray, D. L., McInerney, D. M., & Waters, L. (2014). Social media use and social connectedness in adolescents: The positives and the potential pitfalls. *The Australian Educational and Developmental Psychologist, 31*(1), 18–31. https://doi.org/10.1017/edp.2014.2
4. Allen, K.-A., Kern, M. L., Rozek, C. S., McInerney, D. M., & Slavich, G. M. (2021). Belonging: A review of conceptual issues, an integrative framework, and directions for future research. *Australian Journal of Psychology, 73*(1), 1–16. https://doi.org/10.1080/00049530.2021.1883409
5. Araujo, T. (2018). Living up to the chatbot hype: The influence of anthropomorphic design cues and communicative agency framing on conversational agent and company perceptions. *Computers in Human Behavior*, *85*, 183–189. https://doi.org/10.1016/j.chb.2018.03.051
6. Armstrong, M., (2022). *Infographic: Friendships: Less is now more*. (n.d.). Statista Infographics. https://www.statista.com/chart/28560/number-of-close-friends/
7. Asch, D. A. (2023). An interview with ChatGPT about health care. *NEJM Catalyst Innovations in Care Delivery*, *4*(2).
8. Asher, S. R., & Weeks, M. S. (2013). Loneliness and belongingness in the college years. *The Handbook of Solitude*, 283–301. https://doi.org/10.1002/9781118427378.ch16
9. Aung, K., Nurumal, M. S., & Bukhari, W. (2017). Loneliness among elderly in nursing homes. *International Journal for Studies on Children, Women, Elderly And Disabled, 2*, 72–78.
10. Australian Psychological Society, A. P. (2018). Australian loneliness report: A survey exploring the loneliness levels of Australians and the impact on their health and wellbeing. *Australian Psychological Society.* https://psychology.org.au/for-the-public/psychology-topics/loneliness
11. Avila-Chauvet, L., Mejía, D., & Acosta Quiroz, C. O. (2023, January 18). *Chatgpt as a support tool for online behavioral task programming*. Social Science Research Network. https://ssrn.com/abstract=4329020
12. Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497
13. Bemelmans, R., Gelderblom, G. J., Jonker, P., & de Witte, L. (2012). Socially assistive robots in elderly care: A systematic review into effects and effectiveness. *Journal of the American Medical Directors Association, 13*(2), 114-120.e1. https://doi.org/10.1016/j.jamda.2010.10.002
14. Brandtzaeg, P. B., Skjuve, M., & Følstad, A. (2022). My AI friend: How users of a social Chatbot understand their human–AI friendship. *Human Communication Research., 8*(3), 404–429. https://doi.org/10.1093/hcr/hqac008
15. Bruffaerts, R., Mortier, P., Kiekens, G., Auerbach, R. P., Cuijpers, P., Demyttenaere, K., Green, J. G., Nock, M. K., & Kessler, R. C. (2018). Mental health problems in college freshmen: Prevalence and academic functioning. *Journal of Affective Disorders, 225*(1), 97–103. https://doi.org/10.1016/j.jad.2017.07.044
16. Brunet-Gouet, E., Vidal, N., & Roux, P. (2023). Do conversational agents have a theory of mind? *A single case study of ChatGPT with the Hinting, False Beliefs and False Photographs, and Strange Stories paradigms.* https://doi.org/10.5281/zenodo.7637476
17. Clark, L., Munteanu, C., Wade, V., Cowan, B. R., Pantidi, N., Cooney, O., Doyle, P., Garaialde, D., Edwards, J., Spillane, B., Gilmartin, E., & Murad, C. (2019). What makes a good

conversation? Challenges in designing truly conversational agents. In *Proceedings of the 2019 CHI conference on human factors in computing systems—CHI '19*. https://doi.org/10.1145/3290605.3300705
18. Coeckelbergh, M. (2012). Care robots, virtual virtue, and the best possible life. In *The good life in a technological age* (pp. 299–310). Routledge.
19. Colace, F., De Santo, M., Lombardi, M., Pascale, F., Pietrosanto, A., & Lemma, S. (2018). Chatbot for e-learning: A case of study. *International Journal of Mechanical Engineering and Robotics Research*, *7*(5), 528–533.
20. Cotton, D. R. E., Cotton, P. A., & Shipway, J. R. (2023). Chatting and cheating: Ensuring academic integrity in the era of ChatGPT. *Innovations in Education and Teaching International*, 1–12. https://doi.org/10.1080/14703297.2023.2190148
21. Crawford, J., Cowling, M., & Allen, K. (2023). Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI). *Journal of University Teaching and Learning Practice, 20*(3). https://doi.org/10.53761/1.20.3.02
22. Cresswell, K., Cunningham-Burley, S., & Sheikh, A. (2018). Health care robotics: Qualitative exploration of key challenges and future directions. *Journal of Medical Internet Research, 20*(7), e10410. https://doi.org/10.2196/10410
23. Croes, E. A. J., & Antheunis, M. L. (2020). Can we be friends with Mitsuku? A longitudinal study on the process of relationship formation between humans and a social chatbot. *Journal of Social and Personal Relationships, 38*(1), 279–300. https://doi.org/10.1177/0265407520959463
24. D'Alfonso, S. (2020). AI in mental health. *Current Opinion in Psychology, 36*, 112–117. https://doi.org/10.1016/j.copsyc.2020.04.005
25. De Graaf, M. M. A. (2016). An ethical evaluation of human-robot relationships. *International Journal of Social Robotics, 8*(4), 589–598. https://doi.org/10.1007/s12369-016-0368-5
26. De Luca, S. M., Franklin, C., Yueqi, Y., Johnson, S., & Brownson, C. (2016). The relationship between suicide ideation, behavioral health, and college academic performance. *Community Mental Health Journal, 52*(5), 534–540. https://doi.org/10.1007/s10597-016-9987-4
27. Demange, M., Lenoir, H., Pino, M., Cantegreil-Kallen, I., Rigaud, A. S., & Cristancho-Lacroix, V. (2018). Improving well-being in patients with major neurodegenerative disorders: Differential efficacy of brief social robot-based intervention for 3 neuropsychiatric profiles. *Clinical Interventions in Aging, 13*, 1303–1311. https://doi.org/10.2147/cia.s152561
28. Denecke, K., Abd-Alrazaq, A., & Househ, M. (2021). Artificial intelligence for Chatbots in mental health: Opportunities and challenges. *Multiple Perspectives on Artificial Intelligence in Healthcare*, 115–128. https://doi.org/10.1007/978-3-030-67303-1_10
29. Denker, J. S., Schwartz, D. K., Wittner, B. S., Solla, S. A., Howard, R. J., Jackel, L. D., & Hopfield, J. J. (1987). *Large Automatic Learning, Rule Extraction, and Generalization, 1.*
30. Dosovitsky, G., & Bunge, E. L. (2021). Bonding with bot: User feedback on a Chatbot for social isolation. *Frontiers in Digital Health, 3*, 735053. https://doi.org/10.3389/fdgth.2021.735053
31. Fitzpatrick, K. K., Darcy, A., & Vierhile, M. (2017). Delivering cognitive behavior therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (Woebot): A randomized controlled trial. *JMIR Mental Health, 4*(2), e19. https://doi.org/10.2196/mental.7785
32. Garcia-Mendez, S., De Arriba-Perez, F., Gonzalez-Castano, F. J., Regueiro-Janeiro, J. A., & Gil-Castineira, F. (2021). Entertainment Chatbot for the digital inclusion of elderly people without abstraction capabilities. *IEEE Access, 9*, 75878–75891. https://doi.org/10.1109/access.2021.3080837
33. Gasteiger, N., Loveys, K., Law, M., & Broadbent, E. (2021). Friends from the future: A scoping review of research into robots and computer agents to combat loneliness in older people. *Clinical Interventions in Aging, 16*, 941–971. https://doi.org/10.2147/cia.s282709
34. Gillen-O'Neel, C. (2019). Sense of belonging and student engagement: A daily study of first- and continuing-generation college students. *Research in Higher Education, 62*, 45–71. https://doi.org/10.1007/s11162-019-09570-y

35. Gomes, C., Hendry, N. A., De Souza, R., Hjorth, L., Richardson, I., Harris, D., & Coombs, G. (2021). Higher Degree Students (HDR) during COVID-19. *Journal of International Students*, *11*(S2), 19–37. https://doi.org/10.32674/jis.v11is2.3552
36. Grau, S., Kleiser, S., & Bright, L. (2019). Exploring social media addiction among student Millennials. *Qualitative Market Research*, *22*(2), 200–216. https://doi.org/10.1108/QMR-02-2017-0058
37. Haenlein, M., & Kaplan, A. (2019). A brief history of artificial intelligence: On the past, present, and future of artificial intelligence. *California Management Review, 61*(4), 5–14. https://doi.org/10.1177/0008125619864925
38. Hagerty, A., & Rubinov, I. (2019). Global AI ethics: A review of the social impacts and ethical implications of artificial intelligence. https://arxiv.org/abs/1907.07892
39. Heidegger, M. (1962). *Being and time.* Harper and Row Publishers.
40. Hermann, E. (2021). Anthropomorphized artificial intelligence, attachment, and consumer behavior. *Marketing Letters, 33*, 157–162. https://doi.org/10.1007/s11002-021-09587-3
41. Ho, A., Hancock, J., & Miner, A. S. (2018). Psychological, relational, and emotional effects of self-disclosure after conversations with a chatbot. *Journal of Communication, 68*(4), 712–733. https://doi.org/10.1093/joc/jqy026
42. Hu, K. (2023, February 2). ChatGPT sets record for fastest-growing user base—Analyst note. *Reuters.* https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/
43. Humphries, R., Thorlby, R., Holder, H., Hall, P., & Charles, A. (2016). Social care for older people. In *The kings fund: Home truths.* London.
44. Hung, L., Gregorio, M., Mann, J., Wallsworth, C., Horne, N., Berndt, A., Liu, C., Woldum, E., Au-Yeung, A., & Chaudhury, H. (2019). Exploring the perceptions of people with dementia about the social robot PARO in a hospital setting. *Dementia, 20*(2), 485–504. https://doi.org/10.1177/1471301219894141
45. Juárez Olguín, H., Calderón Guzmán, D., Hernández García, E., & Barragán Mejía, G. (2016). The role of dopamine and its dysfunction as a consequence of oxidative stress. *Oxidative Medicine and Cellular Longevity, 1*, 1–13. https://doi.org/10.1155/2016/9730467
46. King, M. R. (2023). Can Bard, Google's experimental Chatbot based on the LaMDA large language model, help to analyze the gender and racial diversity of authors in your cited scientific references? *Cellular and Molecular Bioengineering, 16*(2), 175–179. https://doi.org/10.1007/s12195-023-00761-3
47. Baki, K. A. (2023). *Conversational AI-powered design: ChatGPT as Dekocasigner, user, and product*. Cornell University. https://doi.org/10.48550/arxiv.2302.07406
48. Kubey, R. W., Lavin, M. J., & Barrows, J. R. (2001). Internet use and collegiate academic performance decrements: Early findings. *Journal of Communication, 51*(2), 366–382. https://doi.org/10.1111/j.1460-2466.2001.tb02885.x
49. Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences, 13*(4), 410. https://doi.org/10.3390/educsci13040410
50. Lozano-Blasco, R., Robres, A. Q., & Sánchez, A. S. (2022). Internet addiction in young adults: A meta-analysis and systematic review. *Computers in Human Behavior, 130*, 107201. https://doi.org/10.1016/j.chb.2022.107201
51. Lutz, C. (2019). Digital inequalities in the age of artificial intelligence and big data. *Human Behavior and Emerging Technologies, 1*(2), 141–148. https://doi.org/10.1002/hbe2.140
52. Ma, Y., & Siau, K. (2018). Artificial intelligence impacts on higher education. *MWAIS 2018 Proceedings, 42*. https://aisel.aisnet.org/mwais2018/42
53. Macit, H. B., Macit, G., & Güngör, O. (2018). A research on social media addiction and dopamine driven feedback. *Mehmet Akif Ersoy Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, *5*(3), 882–897. https://doi.org/10.30798/makuiibf.435845
54. Mahapatra, S. (2019). Smartphone addiction and associated consequences: Role of loneliness and self-regulation. *Behaviour and Information Technology, 38*(8), 833–844. https://doi.org/10.1080/0144929x.2018.1560499

55. Mahesh, B. (2020). Machine learning algorithms-a review. *International Journal of Science and Research (IJSR), 9*(1), 381–386. https://doi.org/10.21275/ART20203995
56. Martindale, J. (2023, April 12). These are the countries where ChatGPT is currently banned. *Digital Trends*. https://www.digitaltrends.com/computing/these-countries-chatgpt-banned/
57. McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (2019). A proposal for the Dartmouth summer research project on artificial intelligence, August 31, 1955. *AI Magazine, 27*(4), 12–12. https://doi.org/10.1609/aimag.v27i4.1904
58. Meehan, C., & Howells, K. (2018). In search of the feeling of "belonging" in higher education: Undergraduate students transition into higher education. *Journal of Further and Higher Education, 43*(10), 1376–1390. https://doi.org/10.1080/0309877x.2018.1490702
59. Mellor, D., Stokes, M., Firth, L., Hayashi, Y., & Cummins, R. (2008). Need for belonging, relationship satisfaction, loneliness, and life satisfaction. *Personality and Individual Differences, 45*(3), 213–218. https://doi.org/10.1016/j.paid.2008.03.020
60. Meng, J., & Dai, Y. (2021). Emotional support from AI Chatbots: Should a supportive partner self-disclose or not? *Journal of Computer-Mediated Communication, 26*(4), 207–222. https://doi.org/10.1093/jcmc/zmab005
61. Mieleszczenko-Kowszewicz, W., Kamil Warpechowski, Zieliński, K., Radoslaw Nielek, & Wierzbicki, A. P. (2022). *Tell me how you feel: Designing emotion-aware Voicebots to ease pandemic anxiety in aging citizens*. https://doi.org/10.48550/arxiv.2207.10828
62. Milne-Ives, M., de Cock, C., Lim, E., Shehadeh, M. H., de Pennington, N., Mole, G., Normando, E., & Meinert, E. (2020). The effectiveness of artificial intelligence conversational agents in health care: Systematic review. *Journal of Medical Internet Research, 22*(10), e20346. https://doi.org/10.2196/20346
63. Mou, Y., & Xu, K. (2017). The media inequality: Comparing the initial human-human and human-AI social interactions. *Computers in Human Behavior, 72*, 432–440. https://doi.org/10.1016/j.chb.2017.02.067
64. Nadimpalli, M. (2017). Artificial intelligence risks and benefits. *International Journal of Innovative Research in Science, Engineering and Technology*, *6*(6).
65. O'Shea, S. (2020). "Kids from here don't go to uni": Considering first in family students' belonging and entitlement within the field of higher education in Australia. *European Journal of Education, 56*(1), 65–77. https://doi.org/10.1111/ejed.12434
66. Olujimi, P. A., & Ade-Ibijola, A. (2023). NLP techniques for automating responses to customer queries: A systematic review. *Discover Artificial Intelligence, 3*(1), 20. https://doi.org/10.1007/s44163-023-00065-5
67. Pearson, J. E. (1986). The definition and measurement of social support. *Journal of Counseling and Development, 64*(6), 390–395. https://doi.org/10.1002/j.1556-6676.1986.tb01144.x
68. Pedler, M. L., Willis, R., & Nieuwoudt, J. E. (2021). A sense of belonging at university: Student retention, motivation and enjoyment. *Journal of Further and Higher Education, 46*(3), 397–408. https://doi.org/10.1080/0309877x.2021.1955844
69. Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: ChatGPT and beyond. *Journal of University Teaching and Learning Practice*, *20*(2). https://doi.org/10.53761/1.20.02.07
70. Pinquart, M., & Sorensen, S. (2001). Influences on loneliness in older adults: A meta-analysis. *Basic and Applied Social Psychology, 23*(4), 245–266. https://doi.org/10.1207/s15324834basp2304_2
71. Porkodi, S., & Kesavaraja, D. (2021). Healthcare robots enabled with IoT and artificial intelligence for elderly patients. *AI and IoT-Based Intelligent Automation in Robotics*, 87–108. https://doi.org/10.1002/9781119711230.ch6
72. Rad, D. & G. Rad (2023). Exploring the psychological implications of chatGPT: A qualitative study. *Journal Plus Education, 32*(1), 43–55. https://doi.org/10.24250/jpe/vol.321/2023/dr/gr
73. Ram, B., & Pratima Verma, P. V. (2023). Artificial intelligence AI-based Chatbot study of ChatGPT, Google AI Bard and Baidu AI. *World Journal of Advanced Engineering Technology and Sciences*, *8*(1), 258–261. https://doi.org/10.30574/wjaets.2023.8.1.0045

74. Rathnayaka, P., Mills, N., Burnett, D., De Silva, D., Alahakoon, D., & Gray, R. (2022). A mental health Chatbot with cognitive skills for personalised behavioural activation and remote health monitoring. *Sensors, 22*(10), 3653. https://doi.org/10.3390/s22103653
75. Ring, L., Shi, L., Totzke, K., & Bickmore, T. (2015). Social support agents for older adults: Longitudinal affective computing in the home. *Journal on Multimodal User Interfaces, 9*(1), 79–88. https://doi.org/10.1007/s12193-014-0157-0
76. Ryan, T., Allen, K. A., Gray, D. L., & McInerney, D. M. (2017). How social are social media? A review of online social behaviour and connectedness. *Journal of Relationships Research*, *8*(8). https://doi.org/10.1017/jrr.2017.13
77. Sagar, M., Seymour, M., & Henderson, A. (2016). Creating connection with autonomous facial animation. *Communications of the ACM, 59*(12), 82–91. https://doi.org/10.1145/2950041
78. Sands, S., Ferraro, C., Campbell, C., & Tsao, H.-Y. (2020). Managing the human–chatbot divide: How service scripts influence service experience. *Journal of Service Management, 32*(2), 246–264. https://doi.org/10.1108/josm-06-2019-0203
79. Schall, J., Wallace, T. L., & Chhuon, V. (2014). "Fitting in" in high school: How adolescent belonging is influenced by locus of control beliefs. *International Journal of Adolescence and Youth, 21*(4), 462–475. https://doi.org/10.1080/02673843.2013.866148
80. Sepahpour, T. (2020, August 18). *Ethical considerations of Chatbot use for mental health support*. Jscholarship.library.jhu.edu. http://jhir.library.jhu.edu/handle/1774.2/63294
81. Shah, H. (2006). ALICE: an ACE in digitaland. *tripleC: Communication, Capitalism and Critique. Open Access Journal for a Global Sustainable Information Society*, *4*(2), 284–292. https://triple-c.at/index.php/tripleC/article/view/46
82. Shekhar, S. S. (2019). Artificial intelligence in automation. *Research Review Journals 4*(6). https://doi.org/10.5281/zenodo.3247197
83. Sherer, J., & Levounis, P. (2022). Technological addictions. *Current Psychiatry Reports, 24*(9), 399–406. https://doi.org/10.1007/s11920-022-01351-2
84. Shibata, T. (2012). Therapeutic seal robot as biofeedback medical device: Qualitative and quantitative evaluations of robot therapy in dementia care. *Proceedings of the IEEE, 100*(8), 2527–2538. https://doi.org/10.1109/jproc.2012.2200559
85. Shum, H., He, X., & Li, D. (2018). From Eliza to XiaoIce: Challenges and opportunities with social chatbots. *Frontiers of Information Technology and Electronic Engineering, 19*(1), 10–26. https://doi.org/10.1631/fitee.1700826
86. Singh, S., & Sagar, R. (2022). Time to have effective regulation of the mental health apps market: Maximize gains and minimize harms. *Indian Journal of Psychological Medicine, 44*(4), 399–404. https://doi.org/10.1177/02537176221082902
87. Skjuve, M., Følstad, A., Fostervold, K. I., & Brandtzaeg, P. B. (2021). My Chatbot companion—A study of human-Chatbot relationships. *International Journal of Human-Computer Studies, 149*, 102601. https://doi.org/10.1016/j.ijhcs.2021.102601
88. Slaten, C. D., Ferguson, J. K., Allen, K.-A., Brodrick, D.-V., & Waters, L. (2016). School belonging: A review of the history, current trends, and future directions. *The Educational and Developmental Psychologist, 33*(1), 1–15. https://doi.org/10.1017/edp.2016.6
89. Song, X., Xu, B., & Zhao, Z. (2022). Can people experience romantic love for artificial intelligence? An empirical study of intelligent assistants. *Information and Management, 59*(2), 103595. https://doi.org/10.1016/j.im.2022.103595
90. Sparrow, R., & Sparrow, L. (2006). In the hands of machines? The future of aged care. *Minds and Machines, 16*(2), 141–161. https://doi.org/10.1007/s11023-006-9030-6
91. Srinivas, K. K., Peddi, A., Srinivas, B. G. S., Vardhini, P. A. H., Prasad, H. L. P., & Choudhary, S. K. (2022, March 1). Artificial intelligence techniques for Chatbot applications. In *2022 International mobile and embedded technology conference (MECON)*. https://doi.org/10.1109/MECON53876.2022.9751887
92. Stickley, A., Koyanagi, A., Leinsalu, M., Ferlander, S., Sabawoon, W., & McKee, M. (2015). Loneliness and health in Eastern Europe: Findings from Moscow, Russia. *Public Health, 129*(4), 403–410. https://doi.org/10.1016/j.puhe.2014.12.021

93. Sullivan, Y., Nyawa, S., & Fosso Wamba, S. (2023). Combating loneliness with artificial intelligence: An AI-based emotional support model. *Hawaii International Conference on System Sciences, 56.* https://hdl.handle.net/10125/103173
94. Ta, V., Griffith, C., Boatfield, C., Wang, X., Civitello, M., Bader, H., DeCero, E., & Loggarakis, A. (2020). User experiences of social support from companion Chatbots in everyday contexts: Thematic analysis. *Journal of Medical Internet Research, 22*(3), e16235. https://doi.org/10.2196/16235
95. Torous, J., Onnela, J.-P., & Keshavan, M. (2017). New dimensions and new tools to realize the potential of RDoC: Digital phenotyping via smartphones and connected devices. *Translational Psychiatry, 7*(3), e1053–e1053. https://doi.org/10.1038/tp.2017.25
96. Turel, O., Serenko, A., & Giles, P. (2011). Integrating technology addiction and use: An empirical investigation of online auction users. *MIS Quarterly, 35*(4), 1043–1061. https://doi.org/10.2307/41409972
97. Turing, A. M. (2009). *Computing machinery and intelligence.* Parsing the Turning Test. Springer Netherlands.
98. Ulmanen, S., Soini, T., Pietarinen, J., & Pyhältö, K. (2016). Students' experiences of the development of emotional engagement. *International Journal of Educational Research, 79*, 86–96. https://doi.org/10.1016/j.ijer.2016.06.003
99. Valtolina, S., & Hu, L. (2021). Charlie: A chatbot to improve the elderly quality of life and to make them more active to fight their sense of loneliness. In *CHItaly 2021: 14th biannual conference of the Italian SIGCHI chapter*. https://doi.org/10.1145/3464385.3464726
100. Varrella, S. (2021, November 4). *Loneliness among adults worldwide by country 2021.* Statista. https://www.statista.com/statistics/1222815/loneliness-among-adults-by-country/
101. Wada, K., Shibata, T., Musha, T., & Kimura, S. (2008). Robot therapy for elders affected by dementia. *IEEE Engineering in Medicine and Biology Magazine, 27*(4), 53–60. https://doi.org/10.1109/memb.2008.919496
102. Wallach, W., & Allen, C. (2010). *Moral machines: Teaching robots right from wrong*. Oxford University Press.
103. Weizenbaum, J. (1966). ELIZA—A computer program for the study of natural language communication between man and machine. *Communications of the ACM, 9*(1), 36–45. https://doi.org/10.1145/365153.365168
104. Nirmalie Wiratunga, Cooper, K., Anjana Wijekoon, Chamath Palihawadana, Mendham, V., Reiter, E., & Martin, K. E. (2020). *FitChat: Conversational artificial intelligence interventions for encouraging physical activity in older adults.*
105. Wu, Y.-H., Fassert, C., & Rigaud, A.-S. (2012). Designing robots for the elderly: Appearance issue and beyond. *Archives of Gerontology and Geriatrics, 54*(1), 121–126. https://doi.org/10.1016/j.archger.2011.02.003
106. Xie, T., & Pentina, I. (2022). Attachment theory as a framework to understand relationships with social Chatbots: A case study of Replika. scholarspace.manoa.hawaii.edu. http://hdl.handle.net/10125/79590
107. Xie, T., Iryna Pentina, & Hancock, T. (2023). *Friend, mentor, lover: Does chatbot engagement lead to psychological dependence?* https://doi.org/10.1108/josm-02-2022-0072
108. Zang, Y., Zhang, F., Di, C., & Zhu, D. (2015). Advances of flexible pressure sensors toward artificial intelligence and health care applications. *Materials Horizons, 2*(2), 140–156. https://doi.org/10.1039/c4mh00147h