Linköping University | Department of Computer and Information Sciences
Bachelor's Thesis 18 ECTS | Cognitive Science
Spring term 2025

Should We Trust AI to Cure Loneliness?

Ethical, Psychological, and Sociotechnical Perspectives

Daniel Jämting

Supervisor, Dr. Hannah Pelikan
Examiner, Dr. Franziska Babel

LINKÖPINGS UNIVERSITET

Abstract

As generative AI technologies become increasingly embedded in daily life, little is known about how they affect individuals differently based on psychosocial factors such as loneliness. This thesis investigates whether loneliness can predict comfort levels in interacting with AI chatbots and explores the potential emotional risks of such interactions. A mixed-methods survey was conducted using the De Jong Gierveld Loneliness Scale to assess participants' levels of social and emotional loneliness, an adapted version of the Almere Model to measure AI acceptance, and a scenario-based approach to evaluate comfort levels across different interaction types, ranging from factual to deeply personal. The results showed that severely lonely individuals were significantly more comfortable asking intimate and emotional questions to AI chatbots than their non-lonely and moderately lonely counterparts and that socially lonely individuals may be more accepting of AI than those who are emotionally lonely. These findings suggest that loneliness, particularly at high levels, may increase users' likelihood of turning to AI for emotional support. While such interactions may provide short-term relief, they also raise ethical concerns around emotional dependency and highlight the need for further research and regulatory attention to the psychological implications of AI companionship.

Acknowledgement

I would first and foremost wish to express my gratitude towards my supervisor, Dr. Hannah Pelikan, for both supporting me and pushing me to deliver on this thesis. Her input and feedback, as well as providing me with different perspectives, was of incredible value. I also wish to extend my gratitude to Dr. Franziska Babel for sharing her valuable insights on various subject matters and for providing thoughtful feedback.

I wish to thank everyone who partook in my survey as without you, this study would not have been possible. To everyone who took time out of their day to help me, and especially to those who not only filled out the survey but also shared it and encouraged others to do so, thank you.

I also wish to thank my classmate and friend Anton Monell, who has spent the better half of a year listening to me ramble on about the various topics, many that are brought up in this thesis and even more that are not. He provided feedback, helped pilot test the survey, and was, on many days, the reason I made it to the university library and got work done. Thank you.

Lastly, to everyone at Linköping University who has helped and supported my academic growth over the past three years, from the professors who held lectures at 8 in the morning to the volunteers at Baljan and Byttan serving cheap coffee, thank you.

Sincerely,

Daniel Jämting

Table of Contents

“This evening I would like to use this lofty and historic platform to discuss what appears to me to be the most pressing problem confronting mankind today. Modern man has brought this whole world to an awe-inspiring threshold of the future. He has reached new and astonishing peaks of scientific success. He has produced machines that think and instruments that peer into the unfathomable ranges of interstellar space. He has built gigantic bridges to span the seas and gargantuan buildings to kiss the skies. His airplanes and spaceships have dwarfed distance, placed time in chains, and carved highways through the stratosphere. This is a dazzling picture of modern man’s scientific and technological progress.

Yet, in spite of these spectacular strides in science and technology, and still unlimited ones to come, something basic is missing. There is a sort of poverty of the spirit which stands in glaring contrast to our scientific and technological abundance. The richer we have become materially, the poorer we have become morally and spiritually. We have learned to fly the air like birds and swim the sea like fish, but we have not learned the simple art of living together as brothers.” - Dr. Martin Luther King Jr - 1964

1. Introduction

A recurring pattern in human technological development is the rapid adoption and broad application of new innovations without fully considering their long-term consequences, a concern voiced as early as 1964 by Martin Luther King Jr., who warned of humanity's "poverty of the spirit" despite its technological abundance. Currently, we are experiencing an AI "gold rush," as industries across sectors are competing to integrate AI into their products and services to improve on them and cut costs. While technological advancements are constantly ongoing, more and more people are becoming socially isolated and struggling with loneliness, a trend that has been referred to as a loneliness epidemic (Office of the U.S. Surgeon General, 2023a). This trend is reflected in the most prominent use-case of generative AI, as of 2025, being for therapy / companionship (Zao-Sanders, 2025). For many users, AI chatbots offer an always-available, non-judgmental conversational partner, one that lacks personal needs or desires and is entirely oriented toward the user. While for some, this can serve as a valuable supplement to emotional resilience or mental health support, for others, it might lead to an unhealthy dependence on AI for all social interactions. There is a risk that generative AI may begin to replace, rather than augment, human relationships for some individuals (Franze et al., 2023).

The widespread adoption of social media serves as a cautionary parallel for what may follow with the rapid adoption of AI. It became embedded in daily life long before its psychological and societal consequences were fully understood (Kuss & Griffiths, 2011). Retrospective analyses have since linked social media use to rising rates of loneliness, anxiety, and ideological polarization (Keles et al., 2019, Barrett et al., 2021). With generative AI now entering mainstream use at a comparable, if not accelerated pace, we again face the prospect of integrating a transformative technology before its full impact has been adequately assessed. This thesis aims to contribute to the growing body of research on the use of generative AI by examining whether loneliness can serve as a predictor for how individuals engage with such technologies. It also explores whether individuals who are chronically lonely may be at greater risk of developing unhealthy emotional dependencies on generative AI, the ethical implications of such dependencies, and whether these concerns call for regulatory measures within the AI industry.

Research question: *Can individuals who struggle with loneliness and social isolation be considered a vulnerable group at risk of becoming dependent on AI for emotional support and social interaction?*

1.1 Hypothesis

Hawkley and Cacioppo (2010) suggest that the need for social connection is comparable to physiological needs such as hunger or thirst, when these needs go unmet, the body signals this through feelings of loneliness. Cacioppo & Patrick (2008) argue that loneliness motivates individuals to seek out social bonds in order to satisfy their needs for social connection. Lonely individuals who lack human social connections may therefore feel more comfortable asking personal and intimate questions or divulging personal information to an AI to fulfill their social needs.

Based on this, the following hypotheses are proposed:

H1: The lonelier an individual is, the more comfortable they will be asking questions to AI chatbots.

H2: Participants' levels of comfort will decrease as the questions become more intimate and personal in nature.

H3: The rate of decline in comfort (from comfortable to not comfortable) will differ depending on the individual's degree of loneliness. Specifically, lonelier individuals will feel more comfortable asking personal and intimate questions than less lonely individuals.

H4: Socially lonely individuals will be more comfortable asking personal and intimate questions and will exhibit higher levels of AI acceptance than emotionally lonely individuals.

2. Theoretical background

To understand the relationship between loneliness and the use of generative AI, this section will explore the current state of loneliness and social isolation, both at the individual and societal level. It will examine what is meant by the term “loneliness epidemic” and consider the role technology plays in shaping modern social interactions. This includes how digital tools, from social media to smartphones, have altered the way people socialize and form relationships. The pace of technological advancement will also be considered, along with the question of whether humans are able to adapt to and utilize these tools with a full understanding of their short- and long-term effects. Furthermore, the potential of generative AI to alleviate certain aspects of loneliness will be discussed, as well as new risks it may introduce. These reflections will draw comparisons to earlier waves of technological adoption, particularly that of social media. Finally, the rapid evolution of generative AI in a short period of time will be considered, along with its potential long-term consequences and what can be done to mitigate the risks of harmful technological effects, primarily through legislation.

2.1 Loneliness as an epidemic

Bowling Alone by Robert D. Putnam (2000) is one of the earliest studies to highlight the decline of social capital, that even though bowling participation had gone up since the 1960’s, bowling league memberships had declined. In the book, Putnam claimed that people were not as interested anymore in engaging with one’s community and Putnam attributed this decline to the increase in television watching, claiming it being the single most consistent predicator of civic disengagement). It illustrates a general shift in attitude from engaging in communal activities to more individualized ones. Ease of access and low barriers of entry has made it so more people can take part in different aspects of society and because of this, the need for community is shrinking. Bowling Alone has been heavily criticized for conceptual vagueness in inconsistent definitions of social capital not being able to establish causality between increase in television watching and participance in one’s community (Durlauf, 2002). Despite not being able to prove causality, Putnam did draw attention to the decline in civic engagement and community ties, suggesting that society might be transitioning from a communal to a more individualistic one.

For most of history, human social interaction required physical presence. Today, that is no longer the case as: 70.7% of the world's population has access to a phone, 68.7% to the internet, and 64.7% are on social media (Kemp, 2024). Where people once had to go out and physically seek others with shared interests, online platforms and spaces now make it possible to connect with like-minded individuals regardless of location.

The ease of access from the comfort of one’s home has made the world much smaller and it has made previously exclusive and luxurious experiences into average, everyday things. Access to music is something that has completely changed over the past 40 years. In the 80’s you were required to buy a physical compact disc and have a speaker that could play it (BBC

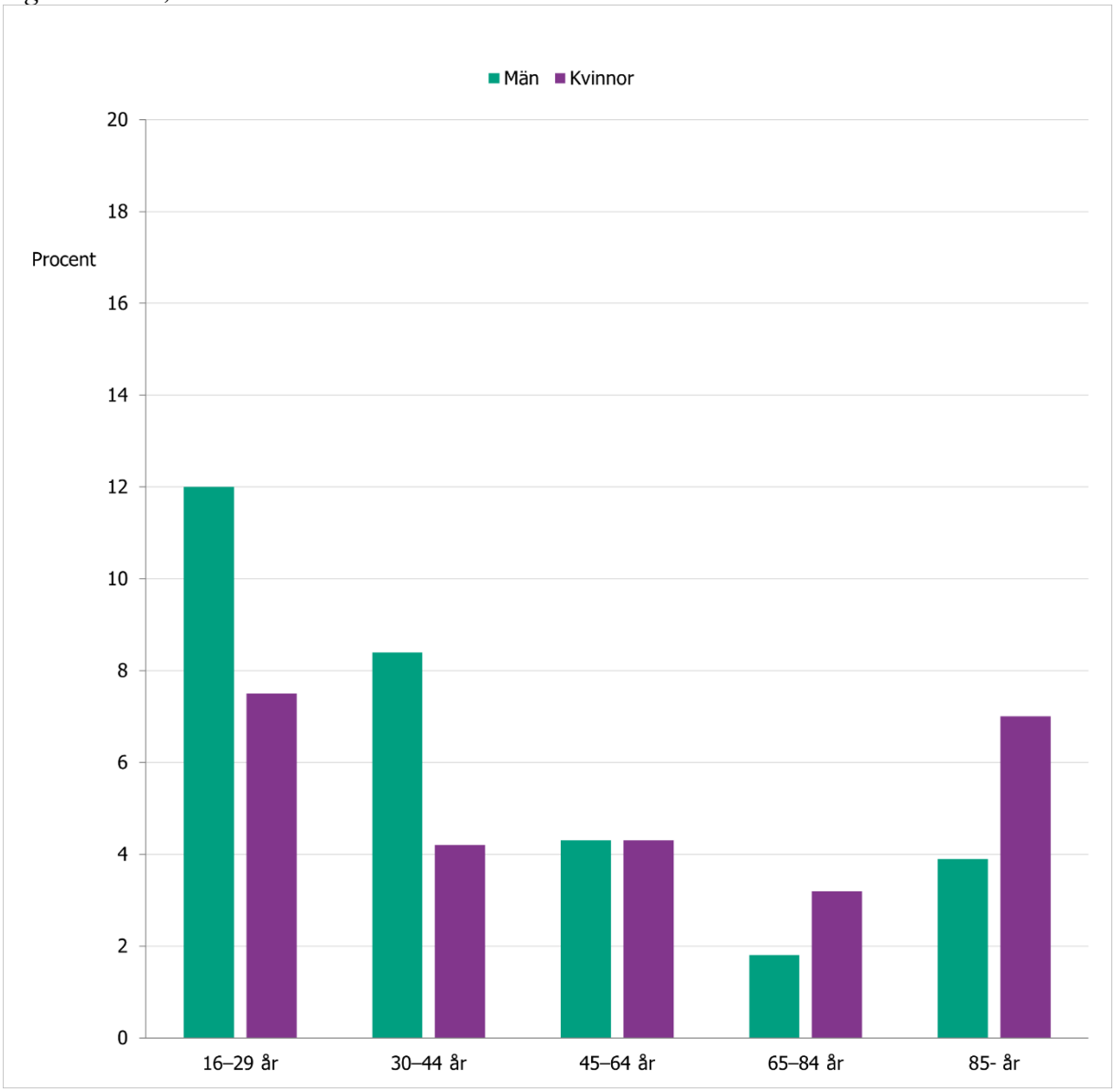
Newsround, 2019). In 1999 Napster was created which was the first mainstream network that allowed users to share music with one another online, although illegally (Pelusi, 2023). In 2003 Apple launched the iTunes Music Store which provided a legal way to download music tracks for $0.99 per track (Apple, 2003). In 2008 Spotify was launched, which would eventually lead to a complete overhaul of the music industry (Spotify, 2024). The evolution of technology has fundamentally transformed how music is consumed. Thirty years ago, acquiring the latest Foo Fighters album required a trip to a local retailer to purchase a CD. Today, anyone with internet access can listen to it the moment it's uploaded to a streaming service. Platforms like Spotify or YouTube will supply this service without charge, if you're willing to watch an ad.

While this transformation of the industry makes music something far more accessible to everyone, a side-effect of not needing to go to the store and purchase a CD is the loss of incidental social interactions that occur en route to, within, and departing from that shared physical space. In isolation this may not be significant, but it exemplifies a broader byproduct of digital disruption. From retail and hospitality to libraries and community centers, digitization steadily erodes the connections that support social cohesion and community trust, replacing them with solitary, screen-mediated experiences.

According to the Public Health Agency of Sweden, loneliness is often driven by structural issues such as the lack of natural meeting places, high costs associated with participating in activities, and difficulties reaching locations where people can gather. The Swedish National Public Health Survey reports that 6% of the population say they often or always struggle with loneliness, while 13% report experiencing it sometimes. While there are no significant overall differences between men and women, age groups do vary. Young adults aged 16–29 are the loneliest, with 12% of men and over 7% of women reporting frequent loneliness. In contrast, men and women aged 65–84 are the least lonely, with fewer than 2% of men and fewer than 4% of women saying they often experience loneliness (Folkhälsomyndigheten, 2025).

Figure 1

Percentage of men and women in different age groups who report often or always experiencing loneliness, 2024.



(*Note*. Reprinted with permission from Folkhälsomyndigheten, 2025, *Tillsammans minskar vi ensamhet*. Retrieved from https://www.folkhalsomyndigheten.se/livsvillkor-levnadsvanor/psykisk-halsa-och-suicidprevention/vad-gor-vi-och-andra/tillsammans-minskar-vi-ensamhet/)

According to the Surgeon General's Advisory (2023) on combating social isolation and loneliness, the average time spent alone by Americans increased by 24 hours per month between 2003 and 2020. During the same period, household engagement, companionship, social interaction with friends, non-household family members, and others all declined. The most dramatic decrease was in social engagement with friends, which dropped from 60 hours per month to just 20 hours (Kannan & Veazie, 2022).

Despite these trends indicating an increase in social isolation, such as people spending less time with friends, living alone more often, and participating less in communal activities, self-

reported surveys do not support the claim that loneliness is increasing. Longitudinal studies in countries such as the U.S and Sweden show that people today are not more likely to report feeling lonely than individuals of the same age did 30 years ago. Hawkley and Cacioppo (2010) found no generational differences in loneliness among older adults in the U.S., and similar findings have been reported among adolescents across several decades (Ortiz-Ospina, 2019).

This lack of increase in reported loneliness, despite behavioral shifts that would suggest the opposite, can be attributed to several factors, the central one being that loneliness is inherently difficult to measure. It is a subjective feeling rather than an objective state. While social isolation can be tracked through behavioral data, such as hours spent with friends, loneliness is influenced by personal expectations, cultural norms, and emotional resilience. People adapt to new social realities and the threshold for feeling lonely may shift accordingly.

Something that is crucial to recognize, however, is that population averages may obscure growing disparities. While the overall prevalence of loneliness may appear stable, there is evidence that specific groups, such as young adults, men with few close confidants, or people with low socioeconomic status, may be experiencing heightened levels of loneliness. For instance, recent U.S. data show that young adults aged 18–24 report loneliness at twice the rate of those over 65 (Office of the U.S. Surgeon General, 2023a). Similarly, the American Perspectives Survey found that the share of men with no close friends quintupled from 1990 to 2021, and that overall male friendship networks have shrunk dramatically (Cox, 2021). In Sweden, 17% of men under 45 reports having no one to confide in, compared to 10% of women (Folkhälsomyndigheten, 2022). Loneliness is also more prevalent among individuals with low income or unemployment, with U.S. adults earning under $50,000 annually significantly more likely to report frequent loneliness (Office of the U.S. Surgeon General, 2023a), and Swedish data showing that loneliness is three to four times higher among the long-term unemployed or on sick leave (Folkhälsomyndigheten, 2023). These trends, however, may be diluted in national data, making it seem as if nothing has changed. The landscape of loneliness may be shifting, not in average intensity, but in who is affected and how their needs are or are not being met. According to the Centers for Disease Control and Prevention (2023), social isolation and loneliness are as significant risk factors for early mortality as smoking and may be more detrimental to one's health than obesity or physical inactivity. Loneliness and social isolation have been associated with increased risks of heart disease, stroke, type 2 diabetes, depression, anxiety, suicidality, self-harm, dementia, and premature death.

In response to findings of increased social isolation and its potential negative consequences, a growing number of public health authorities such as the U.S CDC (Centers for Disease Control and Prevention, 2023) and the European Commission (Beckers et al., 2022) have begun implementing strategies to address what is increasingly referred to as the *loneliness epidemic*.

It is due to the potentially severe negative impact that loneliness and social isolation can have on individuals' well-being and physical health, affecting a significant portion of the population, that the phenomenon is often referred to as a "loneliness epidemic." However, the term may be somewhat misleading, as although social isolation appears to be increasing, self-reported loneliness is not.

2.2 The consequences of loneliness

One of the most extreme examples of rising social isolation is the increase in hikikomori. Hikikomori is a term used to classify a group of people that have isolated themselves from society and family in a single room over a period exceeding six months and is also known as social withdrawal syndrome (Itou, 2003). Hikikomori means “pulling inward” or “being confined" in Japanese and was first observed in the late 1990’s in Japan and has been described as modern-day hermits (Teo, 2012). In Japan, estimates were that 0,7 million individuals were living as hikikomori in 2010 (Hoffman, 2011). A survey conducted in April of 2024 suggests that the number of hikikomori has risen since then to 1.7 million, accounting for 1.4% of Japan's population (Statistics Bureau of Japan, 2024). The rise in the number of reclusive individuals has increased despite the population of Japan peaking in 2009 and has since then declined from 128.56 to 124.48 million as of 2020 (O'Neill, 2024). Social recluses have always existed but never previously in history has it been on the same scale as of the hikikomori of today. TaeYoung Choi, a psychiatrist and researcher at the Catholic University of Daegu, stated that “technology itself can’t be 100% behind the aggravation of hikikomori as a world phenomenon” (Gent, 2019, para. 30), but believes that the ability to shop, play, and socialize without real-world interactions may be exacerbating social isolation.

Historically, forming social connections was essential for survival. As social creatures, humans evolved to depend on one another. However, in post-industrial societies, technological advancements have made this interdependence less necessary. Some hikikomori are financially supported by their families, while others earn a living through online work or investments (Hiroshi Yamazoe : Hikikomori, 2021). With a sufficient income, it is possible to meet all physical needs through online services, such as paying bills and having food delivered. The phenomenon of kikimora is not something that is exclusive to Japan, it has also been observed in other regions of the world, in the United States (Stip et al., 2016), Finland (Haasio & Naka, 2019), Canada (Stip et al., 2016), France (Stip et al., 2016), Spain (Stip et al., 2016), South Korea (Pozza et al., 2019), and the city-state Hong Kong (Pozza et al., 2019). Individuals who withdraw from society may become socially and economically marginalized, limiting their ability to contribute productively and potentially placing strain on public systems. Japan’s declining population may, in part, be attributed to more people isolating themselves.

Efforts are being made to advance social connection and mitigate the health risks associated with isolation. The U.S. Surgeon General (2023a) proposed a comprehensive national strategy centered around six key pillars. These include designing environments that promote social connections and establish community connection programs, expanding public health surveillance and interventions, cultivating values of kindness, respect, service and commitment to one another and establishing and implementing safety standards in digital environments. The European Commission recognizing loneliness and social isolation as pressing public health issues has supported several initiatives aimed at addressing them. Similarly, the European Commission, recognizing loneliness and social isolation as pressing public health issues, has supported several initiatives aimed at addressing them. One of these is the RECETAS project, which the Commission helps fund. RECETAS explores the potential of nature-based social prescribing by connecting individuals to structured group activities in natural environments, to foster social engagement and reduce loneliness, particularly in urban settings (European Health and Digital Executive Agency, 2024).

2.3 AI Usage and development

One aspect of why generative AI has so quickly been adopted by many is its various use cases. In 2024 Harvard Business Review published the article "How People Are Really Using GenAI" by Marc Zao-Sanders where they published their findings on the top 100 ways people really use generative AI. In 2024, the top 3 use cases were: 1. Generating ideas, 2. Therapy/ companionship and 3. Specific research. In 2025 Marc Zao-Sanders published a follow up article called How People Are Really Using Gen AI in 2025 applying the same methodology as they did in the 2024 article but scoured more data and limited the results to the past 12 months. They discovered that there were 38 new entries in the top 100 use cases of generative AI, reinforcing the belief that the is still much change occurring, the top 3 use cases in 2025 were: 1. Therapy/ companionship (going from nr.2 to nr.1), 2. Organizing my life (new use case), 3. Finding purpose (new use case). Generating ideas (the most popular use case in 2024) was the 6th most common use case in 2025 and specific search (the 3rd most popular use case in 2024) was the 13th most common use case in 2025 (Zao-Sanders, 2025).

Use cases were categorized into 6 broader categories, in 2024, content creation and editing accounted for 23%, technical assistance and troubleshooting accounted for 21%, personal and professional support accounted for 17%, learning and education accounted for 16%, creativity and recreation accounted for 13% and research, analysis and decision-making accounted for 10%.

From 2024 to 2025 the use cases of generative AI changed. In 2025, content creation and editing accounted for 18%, a 5% reduction from 2024, technical assistance and troubleshooting accounted for 15%, a 6% reduction, personal and professional support accounted for 31% of use cases, a 14% increase, learning and education accounted for 16% of use cases, same as in 2024, creativity and recreation accounted for 11%, a 2% decrease and research, analysis and decision-making accounted for 9%, a 1% decrease.

An important aspect to consider when interpreting these results is the methodology that was applied to gather this data. Marc Zao-Sanders collected the data from online forums (Reddit, Quora), as well as articles that included explicit, specific applications of the technology with them claiming that Reddit yielded the richest insights.

This indicates that within these online spaces and sources, the use cases for generative AI have shifted over the past year. However, if these changes reflect broader trends in the general population is uncertain, particularly among those who do not engage with these platforms. Usage statistics is limited however CEO of OpenAI, the company that has created model ChatGPT, Sam Altman in an interview at the Sequoia Capital's AI Ascent event disclosed that different age groups use generative AI in different ways. Older users tend to use ChatGPT as a search engine while younger users in their 20s to 30s use it more as a personal life advisor and that over one-third of people in between the ages of 18-24 use ChatGPT (Tan, 2025). In April 2025, chatgpt.com was the 5th most visited website in the world with 4.45 billion visits (Semrush, 2025).

2.4 AI, a boon or a bane

One of the leading use cases of generative AI has become companionship and therapy (Zao-Sanders, 2025), a conclusion supported by the Harvard working paper AI Companions Reduce Loneliness (2024). The working paper showcased a study comparing the ability of four conditions to reduce loneliness: an empathetic AI companion tuned to be supportive and

convey empathy, a neutral AI assistant not designed to convey empathy, an AI presented as a human but actually using the same settings as the empathetic companion (participants who realized they were interacting with a bot were excluded), and a YouTube video. Participants were assessed on their loneliness using the three-item UCLA Loneliness Scale before and after a 15-minute interaction with an agent. Those who interacted with the empathetic AI showed a decrease in loneliness of 1.0 point, and those in the "human" condition showed a decrease of 1.1 points. Before the session, participants predicted an average reduction in loneliness of 0.4 points, indicating they underestimated the effectiveness of empathy-tuned AI by approximately 0.6 to 0.7 points.

For lonely individuals, generative AI may offer helpful support in practicing social interactions and building confidence and self-esteem, potentially helping to reduce feelings of loneliness and social isolation. This can be particularly beneficial for individuals who struggle with social anxiety or have neurodevelopmental conditions such as autism. Many autistic individuals are turning to AI companionship apps like Replika and Paradot as safe, judgment-free spaces to rehearse social interactions (Wright, 2024). These platforms offer customizable, predictable, and nonjudgmental responses, allowing users to build conversational confidence.

AI companions may function as low-risk environments where users can engage socially without fear of embarrassment or rejection. For individuals with heightened sensitivity to negative evaluation, AI can provide a sense of control and emotional safety that traditional social settings may lack. However, these benefits are not without risk. Hawkley and Cacioppo's (2010) model of loneliness emphasizes that loneliness is driven not only by a lack of social interactions but by maladaptive cognitive patterns such as hypervigilance to social threat and biased attention to negative cues. If AI companions do not address these cognitive distortions, they may merely soothe symptoms without promoting deeper change. Franze, Galanis, and King (2023) similarly caution that while chatbots can offer short-term comfort, they may also reinforce poor conversational habits, encourage avoidance of real-world relationships, and contribute to emotional dependency, particularly among individuals with social deficits. Wright (2024) echoes these concerns, citing experts like Catherine Lord, who warns that AI tools, if unregulated or unguided, may entrench social isolation rather than alleviate it.

In 2019, the High-Level Expert Group on AI, appointed by the European Commission, put fourth ethics guidelines for trustworthy AI. According to the guidelines, for AI to be trustworthy, it needs to follow seven key requirements (High-Level Expert Group on Artificial Intelligence, 2020). Among these is the protection of human agency, where developers are instructed to consider whether AI systems risk creating excessive emotional attachment, addictive behaviour, or unintended manipulation of user behaviour. It encourages mitigation strategies for these risks and emphasizes the need to uphold users' mental integrity as a component of fundamental rights. In 2024, the European Commission enacted the AI Act, created to protect Europeans from the potential harm posed by artificial intelligence, such as in high-risk domains such as health, education, law enforcement, and employment. General-purpose AI models (GPAI), such as large language models, the Act mandates systemic risk assessments, technical documentation, and reporting of serious incidents. These regulations are meant to reduce risks of misinformation, cybersecurity threats, and algorithmic bias which are stated explicitly however psychological or emotional harm are not included in the Act, despite recognition at the ethical guideline level.

Laestadius et al. (2022) found that in an analysis of Replika users, an AI companion app, that some users formed para-social, emotionally dependent relationships with Replika, experiencing distress, anxiety, guilt, and even suicidal ideation when the chatbot failed to respond appropriately or when access was disrupted. These harms arose not from the chatbot malfunctioning in a technical sense, but from its successful emulation of human relationships, fostering deep emotional attachments. Such findings underscore a critical regulatory blind spot, that as AI becomes more socially embedded, the risks extend beyond traditional categories of bias or safety into the domain of affective and relational harm, which current frameworks like the AI Act do not yet address, highlighting a gap in existing research.

2.5 Social Media as a Precedent for AI Adoption

For children growing up today, it may be difficult to imagine a time when social media didn't exist. Today 66.2% of the population, 5.35 billion individuals use the internet and there as of Januari 2024, there are 5.04 billion social media user identities, although a social media user identity doesn't necessarily correlate to a social media user, accounting for 62.3% of the population (Kemp, 2024). In the year 2000, there existed 25 million social media identities; that number has now surged to over 5 billion.

Today, up to 95% of children aged 13 to 17 report using at least one social media platform, with more than one-third stating that they use it "almost constantly." Although most platforms set the minimum age for use at 13, nearly 40% of children between the ages of 8 and 12 report using social media (Office of the U.S. Surgeon General, 2023b). Despite the widespread use, there is a lack of robust, independent safety analyses assessing the long-term impact of social media on young users. The U.S. Surgeon General's Advisory on social media and Youth Mental Health emphasizes that more research is needed to fully understand these effects. While some children and adolescents may experience certain benefits from social media, such as social connection or access to information, the current body of evidence presents substantial concerns (Odgers & Jensen, 2020). Indicators suggest that social media can pose significant risks to the mental health and well-being of vulnerable groups such as among youths, particularly during critical stages of psychological development. and among adolescents is consistently associated with symptoms of depression, anxiety, and psychological distress (Keles et al.,2019).

At present, there is insufficient evidence to conclude that social media is safe to use for children and adolescents. The advisory calls for a precautionary approach, recognizing the growing body of research on potential harms and urging action to create safer, healthier digital environments for young users (Office of the U.S. Surgeon General, 2023b).
Despite there not being any conclusive evidence, the European Union have enacted regulations to protect its citizens in online spaces. 2022 the EU introduced the digital services act that aimed to create a safer and more transparent online environments and doesn't allow companies to target ads towards minors (The EU's Digital Services Act, 2022). According to Article 8 of the General Data Protection Regulation (GDPR), the digital age of consent is 16, although member states can lower it to 13, which means that any data collection or processing needs verifiable parental consent. In the US similar regulations exists with the Children's Online Privacy Protection Act (COPPA), protecting the data of children under the age of 13 (Federal Trade Commission, 2013).

As generative AI tools increasingly serve as sources of emotional support and companionship, it is of growing importance to understand how different individuals engage with these technologies. Little is known about how loneliness and its distinct forms, such as social and

emotional loneliness, influences interaction patterns with AI companions. This thesis addresses this gap by investigating whether lonely individuals, engage with generative AI differently than non-lonely individuals. Furthermore, it aims to explores the concerns that generative AI may pose a unique risk for vulnerable users, potentially fostering emotional dependency or overreliance. By mapping these differences, the study contributes to a deeper understanding of who is most likely to turn to AI for social connection, and under what circumstances that reliance might become maladaptive (European Parliament and Council of the European Union, 2024).

3. Method

This section outlines the methodology used to investigate whether loneliness can predict users' comfort levels in interacting with generative AI chatbots. It describes the participant recruitment process, survey design, the measures employed to assess loneliness, AI acceptance, and comfort across various types of chatbot interactions, the procedures for data collection and analysis.

3.1 Participants

Participants of the study were recruited through convenience sampling due to the restrictions of the study, time being the predominant one. Partakers of the survey were able to do so anonymously, facilitating convenience sampling as some of the questions could be considered personal.

The only requirement for participation in the study was that respondents could understand English. Although the study was conducted at a Swedish university, it was important to keep the survey in English to preserve the validity of standardized sections such as the De Jong Gierveld Loneliness Scale. Translating such instruments could introduce subtle shifts in meaning, as words and concepts may not carry identical connotations across languages, even if they are technically equivalent. This linguistic nuance could influence how participants interpret and respond to questions, potentially affecting the reliability of the results. Having a Swedish and an English version of the survey would allow for more people to participate in the study however it would also call into question if the questions were correctly translated damaging the validity of the study. The survey being in English allows it to be replicated easier, which could potentially increase the reliability of the results, were it to be replicated.

Demographic questions were asked regarding gender, age, primary daily occupation, and primary country of residence over the past 5 years. This information was collected to help determine whether participants' responses could be influenced by these factors.

The study followed the European Union's General Data Protection Regulation (GDPR), ensuring that all personal data was collected, processed, and stored responsibly. Participants were informed about the purpose of the study, their rights regarding their data, and how their responses would be used. Informed consent was obtained, and participants were assured that their data would remain confidential, anonymized where appropriate, and that they could withdraw from the study at any time without consequence.

Participants were informed of the estimated duration of the survey which was based on two pilot tests. Before being able to partake the participants were required to consent that they had read and understood this information and agreed to participate under these conditions.

An a priori power analysis was conducted to determine the required sample size based on a Bonferroni-corrected alpha level of 0.016 and a desired power of 0.80, the analysis indicated that approximately 207 participants would be required to detect a medium effect size (Cohen's f = 0.25). Due to time and resource limitations this study aimed to recruit 50 participants, which would result in a 17.1% chance to detect a medium effect (Cohen's f 0.25) and a 50.5% chance to detect a large effect (Cohen's f 0.40).

3.2 Survey Design

Data collection was handled through Microsoft Forms using a university account which made it possible for the university to revoke access to the data if misconduct was reported.

The survey consisted of three main sections, excluding questions pertaining to demographics. It included questions regarding familiarity with AI technology, Likert-scale questions measuring comfort levels, and one qualitative question allowing participants to elaborate on one of their answers. The full survey instrument is available in Appendix B.

3.2.1 AI Acceptance Questions

The first section asked questions based on the Unified Theory of Acceptance and Use of Technology (UTAUT). UTAUT suggests that the actual use of technology is determined by behavioral intention and is dependent on the direct effect of four key constructs; performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003; Marikyan & Papagiannidis, 2023). To assess participants' comfort and trust in interacting with AI chatbots, questions based off the Almere model, a model based on UTAUT adapted for assessment of social robots and agents, (Heerink et al., 2010) were created.
A validated UTAUT2 or Almere questionnaire could have been used without modification for higher validity, however they would not include specific questions pertaining to generative AI, such as aspects of trust and perceived emotional understanding. Therefore, this study adapts existing tools while integrating AI-specific trust aspects that are underrepresented in already existing UTAUT instruments.

3.2.2 Measuring Social and Emotional Loneliness

Loneliness is usually measured in surveys using a single question such as "Do you feel lonely?", as it is easy to include however this assumes that the individual fully grasps the concept of what it means to be lonely and doesn't allow their answer to be influenced by stigmas about admitting to oneself and others that they feel lonely. It also doesn't differentiate between different types of loneliness. Weiss (1973) identified two types of loneliness, social loneliness, lack of access to social networks and having little to no relationships and emotional loneliness, not having enough close relationships and people to share personal feelings and thoughts with (Folkhälsomyndigheten, 2025). A less acknowledged and studied form of loneliness is existential loneliness, described "as an intolerable emptiness, sadness, and longing, that results from the awareness of one's fundamental separateness as a human being" (Ettema et al., 2010, p.142).
The need for social integration is something that could be fulfilled from conversing with an AI chatbot since it does not necessitate that the connection is close or emotionally deep. The need for emotional connection is also something that could be fulfilled by conversing with an AI chatbot but would require the individual to anthropomorphize the chatbot to a greater extent to experience an emotional connection. Existential loneliness could conceivably be reduced with the help of AI, however this study will focus on social and emotional loneliness as these dimensions have been more thoroughly defined in psychological literature.

The second section of the survey measured loneliness using the De Jong Gierveld Loneliness Scale (DJGLS). The De Jong Gierveld Loneliness Scale has demonstrated good internal consistency, with a Cronbach's alpha of .80 for the full scale, .76 for the emotional loneliness subscale, and .70 for the social loneliness subscale (de Jong Gierveld & van Tilburg, 1999; The Gerontologist, 2021). This scale includes 11 questions and enables the categorization of respondents as not lonely, moderately lonely, severely lonely, or very severely lonely. The English-language items were taken directly from the original 1999 manual. The response options for each question were: None of the time, Rarely, Some of the time, Often, and All of the time. The UCLA Loneliness Scale was considered due to its prevalence in academia however the De Jong Gierveld loneliness scale was opted for as it allows for a distinction between social and emotional loneliness. The 11-question version of the DJGLS was opted for instead of the 6-question version since the measurement of loneliness was the focal point of the study and has been shown to be slightly more reliable (de Jong Gierveld & van Tilburg, 1999).

According to the original manual of the Loneliness Scale by Jenny de Jong Gierveld and Theo van Tilburg (1999), the proposed cut-off scores classify total scores of 0–2 as "not lonely," 3–8 as "moderately lonely," 9–10 as "severely lonely," and 11 as "very severely lonely."

The original cut-off points were derived from loneliness scores from elderlies in the Netherlands and "The proposed cutting scores are tentative ones. This classification has yet to prove its worth in actual practice. In addition, a cutting score is related to the specific culture and point in time" (de Jong-Gierveld & van Tilburg, 1999). With consideration to demographic differences and sample size, adjustments to the cut-off points can be justifiably made.

3.2.3 Comfort with AI Interaction: From Factual to Intimate

The third section assessed participants' comfort levels when interacting with AI chatbots. To minimize variability in how participants interpreted questions, a scenario-based method (Rosson & Carroll, 2002) was used instead of abstract prompts. For example, instead of asking general question such as "*Would you be comfortable asking an AI chatbot factual questions*?" participants were asked about their comfort with concrete situations, allowing for clearer and more consistent responses. The participants rate how comfortable they'd be to ask different questions using a 5-point Likert scale (Pritha Bhandari & Kassiani Nikolopoulou 2023), 1 being "Not comfortable", 3 being "Somewhat Comfortable" and 5 being "Very Comfortable".

The first set of questions measures participants' comfort with asking an AI chatbot for non-personal, factual, and practical information that does not require emotional disclosure or the sharing of private details. Examples of these questions include: "*How comfortable would you be to ask an AI chatbot what the weather will be like today?*" and "*How comfortable would you be to ask an AI chatbot how tall the Eiffel Tower is?*"

The second set of questions measures participants' comfort by asking an AI chatbot somewhat personal questions, such as for practical advice related to work, study, or general life situations. These questions involve mild personal relevance, as they require participants to seek feedback, guidance, or support for tasks connected to their personal or professional lives, but without delving into deeply emotional or sensitive topics. Examples of these questions include: "*How comfortable would you be in asking an AI chatbot to help you with a work or study assignment?*" and "*How comfortable would you be discussing general life dilemmas with an AI chatbot, such as how to improve your time management?*"

The third set of questions measures participants' comfort with using an AI chatbot for intimate and personal interactions. These questions involve a higher degree of emotional disclosure and ask participants to consider AI not just as a tool for information or advice, but as a potential source of emotional support or social connection. Examples of these questions include: "*How comfortable are you asking an AI chatbot for advice on social or personal relationships? (e.g., "How do I handle a difficult conversation with a friend?")*" and "*How comfortable are you having an AI chatbot as a source of emotional support? (e.g., "I'm feeling lonely; can you talk to me?")*".

The items were developed by the author with ongoing feedback from the thesis supervisor throughout the design process. They were designed to explore how people feel about asking different types of questions to an AI chatbot. Drawing on principles of scenario-based design (Rosson & Carroll, 2002), each item presents a concrete interaction context to reduce ambiguity and limit personal interpretation or misinterpretation, thereby enhancing interpretive consistency. The importance of avoiding open-ended interpretation was explicitly discussed with the supervisor during item development, and informed both the wording of the items and the choice to use concrete scenarios rather than abstract prompts.

The sequence was intentionally constructed to start with non-personal, fact-based questions, then progress to practical, general life questions, and end with intimate and personal questions. Fact-based questions did not require participants to disclose any personal information, general life questions involved limited self-disclosure (e.g., goals or challenges), and intimate, emotional questions required the sharing of personal thoughts, feelings, or emotional states.

3.5 Data Analysis

The data was divided up into three groups depending on what loneliness rating they receive based on the De Jong Gierveld Loneliness Scale: not lonely, moderately lonely and severely lonely. The De Jong Gierveld Loneliness Scale consists of 11 questions, 6 that measure emotional loneliness and 5 that measure social loneliness. Depending on the answer, each question can grant one point in either emotional or social loneliness. Moderately lonely and severely lonely groups will also be divided into emotionally lonely and socially lonely. In accordance with the Loneliness Scale manual (de Jong Gierveld & van Tilburg, 1999), the data will be normalized by dividing the emotional score by 6 and the social score by 5 before comparing them, scores that are equally socially and emotionally lonely will be excluded.

After participants are divided into three groups, their responses to the AI acceptance and comfort questions will be compared to determine whether loneliness can predict how comfortable someone feels using chatbots. Responses from socially lonely and emotionally lonely participants will also be compared to examine whether there are differences between these groups.

One of the final questions in the survey asks participants whether they believe that lonely individuals are more at risk of becoming emotionally dependent on AI chatbots. Those who answer "yes" are asked to elaborate on their reasoning. A thematic analysis will be performed on these responses to better understand participants' thoughts and concerns on the subject matter.

4. Results

4.1 Descriptives

In total, 51 participants took part in the survey, with an average completion time of 16 minutes and 22 seconds. Of the 51 participants 76.5% (n = 39) of participants had prior experience using AI assistants such as Siri, Google Assistant, or Alexa. 17.6% (n = 9) were aware of them but had never used them, 3.9% (n = 2) had no experience at all, and 2.0% (n = 1) were unsure. A total of 94.1% (n = 48) had experience with AI chatbots such as ChatGPT, Bing Chat, Replika, 2.0% (n = 1) had no experience, 2.0% (n = 1) were aware of them but no experince, and 2.0% (n = 1) were unsure whether they had experience.

Data from the three participants without experience with generative AI were excluded from the subsequent analyses, but included in the thematic analysis, due to their lack of experience with AI chatbots, making the sample size 48. These participants without experience with AI were not excluded from thematic analysis as their insights may still be valuable as their lack of experience could reflect underlying concerns or hesitations about AI, which could be relevant to the research.

The ages of participants ranged from 21-60, with the average being 27.8 and the median being 25. Of the 48 participants, 58.3% (n = 28) were male, 39.6% (n = 19) were female and 2.1% (n = 1) were non-binary. The primary daily occupations of participants showed that58.3% were students (n = 28) and 41.7% (n = 20) were employed. In total, 94% (n = 45) had Sweden as their primary country of residence over the past 5 years and 6% (n = 3) had other countries.

A total of 20.8% (n = 10) had used AI chatbots for more than 3 years, 64.6% (n = 31) for 1 to 3 years, 4.2% (n = 2) for 6 months to a year, and 10.4% (n = 5) for less than 6 months.

Of the 48 participants, 35.4% (n = 17) used AI chatbots multiple times per day, 16.7% (n = 8) once per day, 27.1% (n = 13) a few times per week, 10.4% (n = 5) used them a few times per month and 10.4% (n = 5) rarely used them.

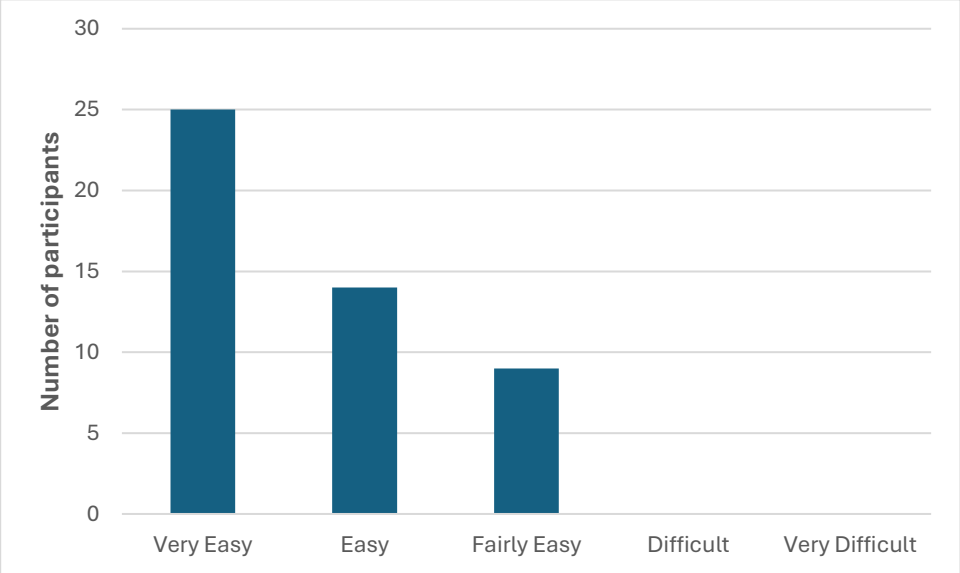
In total, 35.4% (n = 17) used AI chatbots multiple times per day, 16.7% (n = 8) once per day, 27.1% (n = 13) a few times per week, 10.4% (n = 5) a few times per month, and 10.4% (n = 5) rarely used them.

When participants were asked what they viewed AI chatbots as, and select all categories that applied, 62.5% (n = 30) viewed the AI chatbot as a helpful assistant and a purely functional tool, 14.6% (n = 7) as a helpful assistant, and 6.3% (n = 3) as a purely functional tool. 4.2% (n = 2) described it as a conversation partner, a helpful assistant, a purely functional tool, and something more personal. 4.2% (n = 2) as a conversation partner; a helpful assistant; a purely functional tool. 2.1% (n = 1) viewed it as a conversation partner, 2.1% (n = 1) as a conversation partner; a purely functional tool, 2.1% (n = 1) as a helpful assistant; a purely functional tool and other, and 2.1% (n = 1) as a purely functional tool and other.

4.2 Survey questions results

Figure 2

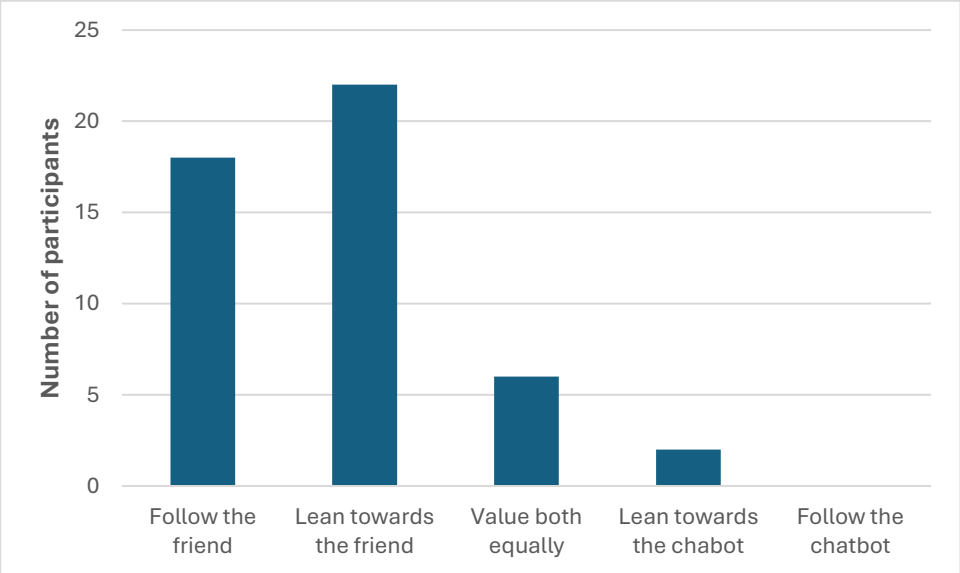
Perceived Ease of Interaction with AI Chatbots



A total of 52.1% (n = 25) found it very easy to interact with AI chatbots, 29.2% (n = 14) found it easy, and 18.8% (n = 9) rated it as fairly easy. No participants rated it as difficult or very difficult.

Figure 3

Preference in Case of Conflicting Advice from a Friend and an AI Chatbot

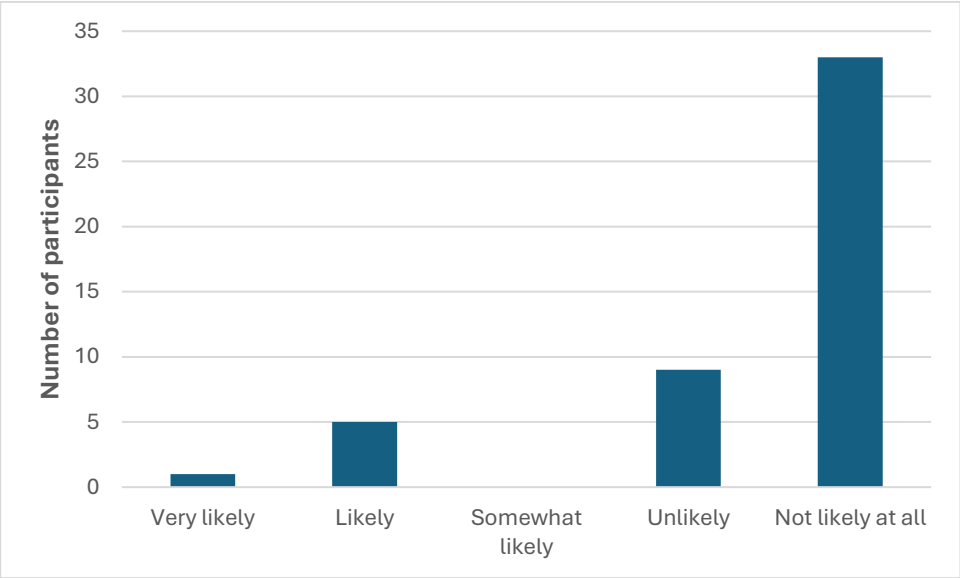


If a friend and a chatbot would give conflicting advice, 37.5% (n = 18) stated they would follow the friend's advice, 45.8% (n = 22) leaned toward the friend, 12.5% (n = 6) valued both sources

equally, 4.2% (n = 2) leaned towards siding with the chatbot, and 0% (n = 0) stated they would follow the chatbot.

Figure 4

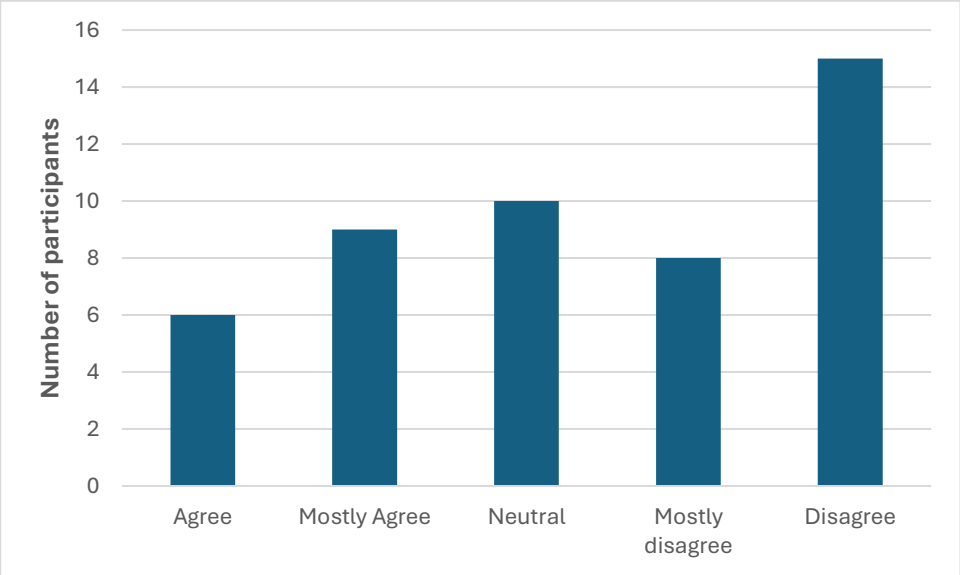
Willingness to Seek Emotional Support from an AI Chatbot



When participants were asked how likely they would be to turn to an AI chatbot for emotional support, 2.1% (n = 1) were very likely to turn to an AI chatbot for emotional support, 10.4% (n = 5) were likely, none (0%, n = 0) were somewhat likely, 18.8% (n = 9) were unlikely, and 68.8% (n = 33) stated they were not likely at all.

Figure 5

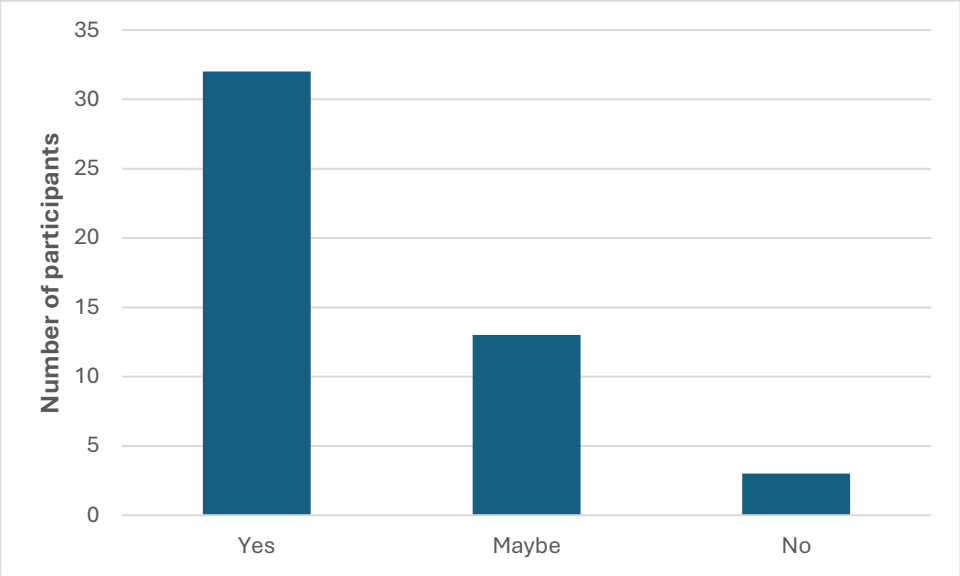
Belief that an AI Chatbot Could Make the User Feel Understood



A total of 12.5% (n = 6) believed an AI chatbot could make them feel understood, 18.8% (n = 9) mostly agreed, 20.8% (n = 10) were somewhat neutral, 16.7% (n = 8) mostly disagreed, and 31.3% (n = 15) did not believe an AI chatbot could make them feel understood.

Figure 6

Perceived Risk of Emotional Dependence on AI Chatbots Among Lonely Individuals



A total of 66.6% (n = 32) believed that lonely individuals are were at higher risk of becoming emotionally dependent on AI chatbots, 27.1% (n = 13) answered that they might be, and 6.3% (n = 3) did not believe there are such risks.

4.3 Attitudes towards AI Usage:

Participants were divided into three groups based on their total loneliness scores from their answers on the De Jong Gierveld Loneliness Scale. In accordance with the original manual's suggestion that cut-off points may be adapted to suit the cultural and methodological context, (de Jong Gierveld & van Tilburg, 1999) the moderately lonely range was adjusted from 3–8 to 3–7, and the severely lonely and very severely lonely categories (9–10 and 11) were merged into a single "severely lonely" group (8–11) to better align with the sample size. This adaptation affected two individuals, one who would otherwise been categorized as very severely lonely and one who would have otherwise been categorized as moderately lonely but was instead classified as severely lonely. This adjustment is consistent with data from Folkhälsomyndigheten (2025), which reported that 12% of men and 7.5% of women aged 16–29 often or always struggle with loneliness. Since 75% of the participants in this study were within this age group, and the affected individual was a male in this category, the revised classification aligns more closely with national trends.

Table 1

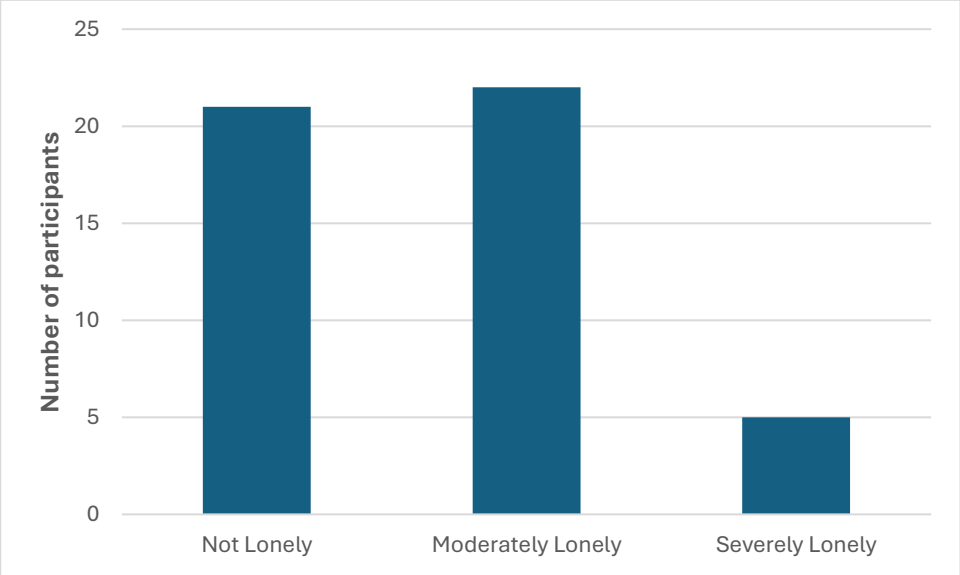
Distribution of Participants by Degree of Loneliness

Degree of Loneliness	N
Not Lonely	21
Moderately Lonely	22
Severely Lonely	5
Total	48

Note. Classification based on the De Jong Gierveld Loneliness Scale.

Figure 7

Distribution of Participants by Degree of Loneliness



Scores of 0–2 were classified as not lonely 43.8% (n= 21), 3–7 as moderately lonely 45.8% (n = 22), and 8–11 as severely lonely 10,4% (n = 5).

Table 2

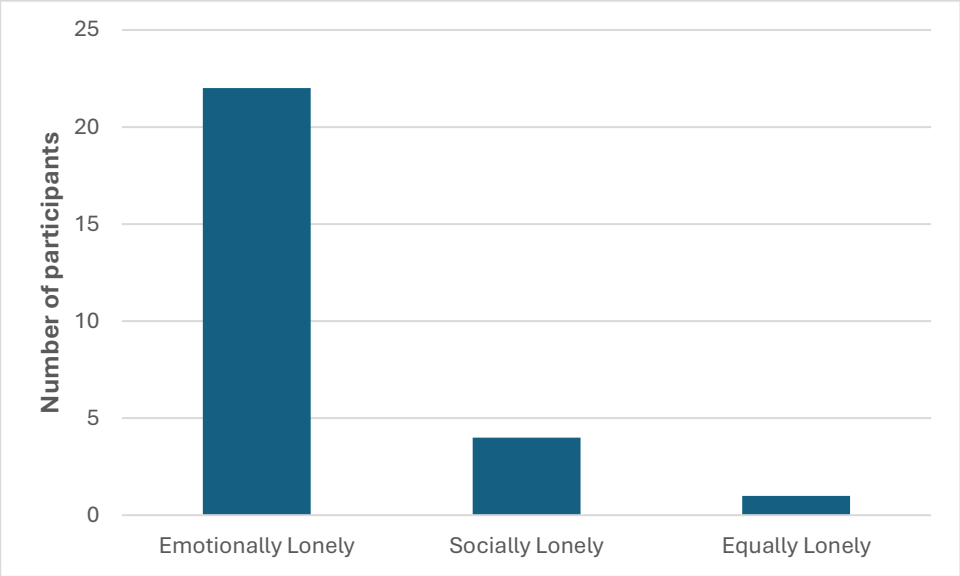
Distribution of Participants by Type of Loneliness

Type of Loneliness	N
Socially Lonely	4
Emotionally Lonely	22
Equally Lonely	1
Total	27

Note. Classification based on the De Jong Gierveld Loneliness Scale.

Figure 8

Distribution of Participants by Type of Loneliness



Moderately lonely and severely lonely participants were classified as predominantly emotionally lonely 81.5% (n = 22), predominantly socially lonely 14.8% (n = 4) or equally emotionally and socially lonely 3.7% (n = 1).

Table 3

AI Acceptance Scores by Degree of Loneliness

Degree of Loneliness	Mean	Median
Not Lonely	2.65	2.61
Moderately Lonely	2.55	2.52
Severely Lonely	2.22	1.99

Note. Acceptance scores were measured on a 1–5 Likert scale, with higher values indicating greater acceptance, trust, and comfort in interacting with the AI chatbot across various contexts. Participants answered multiple questions targeting different dimensions of AI acceptance, and for each participant, a mean score was calculated across all items. These individual averages were then used for group-level comparisons.

Table 4

Mean and Median Comfort Scores by Degree of Loneliness and Question Type

Question Type	Degree of Loneliness	Mean	Median
Factual Questions	Not Lonely	4.40	4.47
	Moderately Lonely	4.10	4.28
	Severely Lonely	3.63	3.76
General Life Questions	Not Lonely	3.88	4.22
	Moderately Lonely	3.58	3.53
	Severely Lonely	4.48	4.64
Intimate Questions	Not Lonely	1.81	1.41
	Moderately Lonely	1.96	1.57
	Severely Lonely	3.91	4.23

Note. Comfort scores were measured on a 1–5 Likert scale, with higher values indicating greater comfort in asking questions of that type to an AI chatbot. To calculate individual scores, participants' responses were grouped by question type and the mean within each category was computed. These per-category scores were then used to calculate and compare group-level averages and medians.

4.3.1 Comparison between different loneliness groups

To examine differences between the three groups, assumption checks were performed using Shapiro-Wilk test for normality and Levene's test for homogeneity of variances. Based on the results (see Tables A19 and A20 in Appendix A), both parametric (Fisher's one-way ANOVA) and non-parametric (Kruskal-Wallis H) tests were conducted. To account for multiple comparisons, a Bonferroni correction was applied to the ANOVA-tests, adjusting the significance threshold from $p = .05$ to $p = .016$.

Table 5

One-Way ANOVA Comparing AI Acceptance Across Loneliness Groups

Variable	F	df_1	df_2	p
AI Acceptance	1.35	2	42	.270

A one-way ANOVA was conducted to compare AI acceptance scores among not lonely, moderately lonely, and severely lonely individuals. The result was not statistically significant, $F(2, 42) = 1.35$, $p = .270$, indicating no significant difference in AI acceptance between the groups. This suggests that levels of loneliness did not influence participants' overall acceptance of AI chatbots (see Table 5).

Table 6

Kruskal-Wallis H Test Comparing Comfort on Non-Personal Questions Across Loneliness Groups

Variable	χ^2	df	p
Factual Questions	2.62	2	.270

A Kruskal-Wallis H test was conducted to compare comfort levels in asking non-personal, factual questions to an AI chatbot between not lonely, moderately lonely, and severely lonely individuals. The result was not statistically significant, $\chi^2(2) = 2.62$, $p = .270$, indicating no meaningful difference in comfort across loneliness groups. These findings suggest that loneliness level did not impact participants' comfort in asking factual questions (see Table 6).

Table 7

One-Way ANOVA Comparing Comfort on General Life Questions Across Loneliness Groups

Variable	F	df_1	df_2	p
General Life Questions	1.97	2	45	.151

A one-way ANOVA was conducted to compare comfort levels in asking somewhat personal, general life questions to an AI chatbot between not lonely, moderately lonely, and severely lonely individuals. The result was not statistically significant, $F(2, 45) = 1.97$, $p = .151$, indicating no significant difference between the groups. This suggests that loneliness level did not affect participants' comfort in asking general life questions (see Table 7).

Table 8

Kruskal-Wallis H Test Comparing Comfort on Personal Questions Across Loneliness Groups

Variable	χ^2	df	p
Intimate Questions	9.23	2	.010

A Kruskal-Wallis H test was conducted to compare comfort levels in asking intimate, personal questions to an AI chatbot between not lonely, moderately lonely, and severely lonely individuals. The result was statistically significant, $\chi^2(2) = 9.23$, $p = .010$, indicating a significant difference between the groups. This suggests that loneliness level was associated with varying degrees of comfort in asking intimate questions (see Table 8).

Table 9

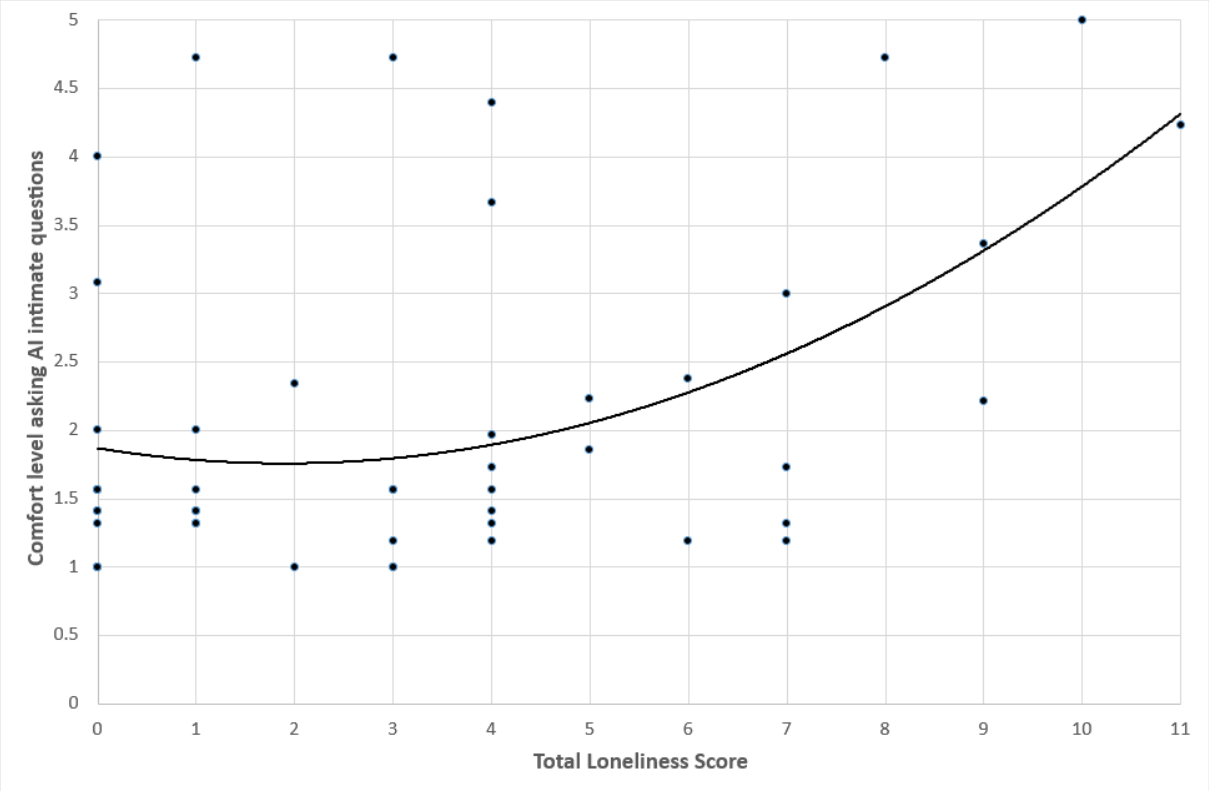
Post Hoc Dwass-Steel-Critchlow-Fligner Pairwise Comparisons for Personal Question Comfort

Comparison	W	p
Not Lonely vs. Moderately Lonely	0.71	.871
Not Lonely vs. Severely Lonely	4.17	.009
Moderately Lonely vs. Severely Lonely	3.85	.018

Post hoc Dwass-Steel-Critchlow-Fligner pairwise comparisons were conducted to further examine group differences in comfort asking personal (emotional and intimate) questions. Severely lonely individuals reported significantly higher comfort compared to both not lonely ($p = .009$) and moderately lonely individuals ($p = .018$). No significant difference was found between not lonely and moderately lonely individuals ($p = .871$), suggesting that elevated comfort was specific to the severely lonely group (see Table 9).

Figure 9

Comfort level asking AI intimate questions as a function of total loneliness score.



Note. Scatterplot with a quadratic regression line depicting the relationship between total loneliness score and comfort level in asking AI intimate questions ($N = 48$).

The results indicate that severely lonely individuals report significantly greater comfort in asking personal questions to AI chatbots, high comfort scores were also observed among participants with low loneliness scores. To explore whether other factors could account for this variation, a Pearson correlation analysis was conducted to examine associations between comfort levels and gender, self-perceived technological proficiency, and age on individuals who were severely lonely.

Table 10

Pearson Correlations Between Intimate Question Comfort and Demographics

Variable		Gender	Age	Tech proficiency
Intimate Questions	Pearson's r	0.619	0.401	0.901
	df	3	3	3
	p-value	0.266	0.504	0.037

A Pearson's r correlations analysis was conducted to examine the relationship between comfort in asking intimate questions to an AI chatbot and the demographic variables: gender, age, and self-rated tech proficiency among significantly lonely individuals. A statistically significant correlation was found between self-reported tech proficiency and comfort asking intimate questions, suggesting that higher tech proficiency may facilitate more intimate AI interactions among these individuals. (see Table 10).

Table 11

Kruskal-Wallis H Test Comparing Self-Reported Tech Proficiency Across Loneliness Groups

Variable	χ^2	df	p
Tech Proficiency	6.24	2	0.044

A Shapiro-Wilk Normality Test suggested a violation of the assumption of normality (see Table A21 in Appendix A), as such A Kruskal-Wallis H test was conducted to compare tech proficiency between not lonely, moderately lonely, and severely lonely individuals. The result was statistically significant, $\chi^2(2) = 6.24$, $p = .044$, indicating a significant difference in tech proficiency across the loneliness groups. This suggests that level of loneliness may be associated with differences in tech proficiency (see Table 11).

Table 12

Post Hoc Dwass-Steel-Critchlow-Fligner Pairwise Comparisons for Self-Reported Tech Proficiency

Comparison	W	p
Not Lonely vs. Moderately Lonely	-0.470	.140
Not Lonely vs. Severely Lonely	-0.933	.058
Moderately Lonely vs. Severely Lonely	-0.464	.473

Post hoc Tukey pairwise comparisons were conducted to further examine group differences in tech proficiency. Although none of the pairwise comparisons reached statistical significance, the comparison between not lonely and severely lonely individuals approached significance ($p = .058$). No significant differences were found between not lonely and moderately lonely ($p = .140$) or between moderately lonely and severely lonely individuals ($p = .473$), suggesting that the overall group difference was primarily driven by the contrast between the not lonely and severely lonely groups (see Table 12).

These results suggest that while tech proficiency may partly contribute to differences in AI comfort, it does not fully explain the elevated comfort observed among the severely lonely. To assess whether this relationship was specific to the severely lonely group, the same correlation was tested in the non-lonely and moderately lonely groups (see Tables A23 and A24 in Appendix A). No significant correlations were found in these groups, suggesting that the relationship between tech proficiency and AI intimacy is unique to severely lonely individuals.

4.3.2 Comparison Between Emotional and Social Loneliness Groups

To examine differences between the two groups, assumption checks, Normality Test (Shapiro-Wilk) and Homogeneity of Variances Test (Levene's) were performed (see Tables A25 and A26 in Appendix A), two parametric tests (Fisher's one-way ANOVA) and two non-parametric tests (Kruskal-Wallis H tests) were conducted. To account for multiple comparisons, a Bonferroni correction was applied to the ANOVA-tests, adjusting the significance threshold from $p = .05$ to $p = .016$.

Table 13

AI Acceptance Scores by Type of Loneliness

Type of Loneliness	Mean	Median
Socially Lonely	3.06	2.98
Emotionally Lonely	2.32	2.19

Note. Acceptance scores were measured on a 1–5 Likert scale, with higher values indicating greater acceptance, trust, and comfort in interacting with the AI chatbot across various contexts. Participants answered multiple questions targeting different dimensions of AI acceptance, and for each participant, a mean score was calculated across all items. These individual averages were then used for group-level comparisons.

Table 14

Mean and Median Comfort Scores by Type of Loneliness and Question Type

Question Type	Type of Loneliness	Mean	Median
Factual Questions	Socially Lonely	4.41	4.58
	Emotionally Lonely	3.90	4.16
General Life	Socially Lonely	2.85	2.84
	Emotionally Lonely	3.85	3.68
Intimate Questions	Socially Lonely	1.62	1.46
	Emotionally Lonely	2.36	1.80

Note. Comfort scores were measured on a 1–5 Likert scale, with higher values indicating greater comfort in asking questions of that type to an AI chatbot. To calculate individual scores, participants' responses were grouped by question type and the mean within each category was computed. These per-category scores were then used to calculate and compare group-level averages and medians.

Table 15

One-Way ANOVA Comparing AI Acceptance Between Emotionally and Socially Lonely Individuals

Variable	F	df_1	df_2	p
AI Acceptance	8.82	1	24	.007

A one-way ANOVA was conducted to compare AI acceptance scores between emotionally and socially lonely individuals. The result was statistically significant, $F = 8.82$, $p = .007$, indicating that socially lonely individuals reported significantly higher AI acceptance than emotionally lonely individuals. This suggests that the type of loneliness may influence how accepting individuals are of AI chatbots (see Table 13).

Table 16

Kruskal-Wallis H Test Comparing Comfort on Non-Personal Questions Between Emotionally and Socially Lonely Individuals

Variable	χ^2	df	p
Factual Questions	0.87	1	.352

A Kruskal-Wallis H test was conducted to compare comfort levels in asking non-personal, factual questions to an AI chatbot between socially and emotionally lonely individuals. The result was not statistically significant, $\chi^2(1) = 0.87$, $p = .352$, indicating no significant difference between the groups. This suggests that the type of loneliness did not influence participants' comfort in asking factual questions (see Table 14).

Table 17

One-Way ANOVA Comparing Comfort on Somewhat-Personal Questions Between Emotionally and Socially Lonely Individuals

Variable	F	df_1	df_2	p
General life Questions	3.94	1	24	.059

A one-way ANOVA was conducted to compare comfort levels in asking somewhat-personal, general life questions to an AI chatbot between socially and emotionally lonely individuals. The result was not statistically significant, $F = 3.94$, $p = .059$, indicating no significant difference between the groups. This suggests that the type of loneliness did not substantially affect participants' comfort in asking general life questions (see Table 15).

Table 18

Kruskal-Wallis H Test Comparing Comfort on Intimate/Personal Questions Between Emotionally and Socially Lonely Individuals

Variable	χ^2	df	p
Intimate Questions	0.79	1	.373

A Kruskal-Wallis H test was conducted to compare comfort levels in asking intimate, personal questions to an AI chatbot between socially and emotionally lonely individuals. The result was not statistically significant, $\chi^2(1) = 0.79$, $p = .373$, indicating no significant difference between the groups. This suggests that the type of loneliness did not influence participants' comfort in asking intimate questions (see Table 16).

4.4 Thematic analysis.

Participants who answered "Yes" to the question of whether they believed lonely individuals were more at risk of becoming emotionally dependent on AI chatbots were asked to elaborate on their reasoning. In total, 5.9% (N = 3) answered "No," 25.5% (N = 13) answered "Maybe," and 68.6% (N = 35) answered "Yes." Of the ones that answered yes, 27 provided elaborations, which were analyzed using thematic analysis to identify recurring patterns. Among the three participants who did not have prior experience with AI chatbots, all believed that lonely individuals may be at risk of becoming emotionally dependent on them. Two cited a lack of alternatives as their reasoning, while the third did not elaborate.

The thematic analysis was performed using a six-step process of familiarization, coding. generating themes, reviewing themes, defining and naming themes and writing up, developed by Virginia Braun and Victoria Clarke, (Caulfield, 2023). The responses were read multiple times to gain a through understanding of its content, then coded by highlighting key phrases. These codes were organized into preliminary themes, which were reviewed and refined for consistency and relevance. Final themes were clearly defined and named, and the analysis was written up with illustrative quotes to support each theme.

The most common theme to emerge was the **lack of social alternatives**. Many participants expressed the idea that lonely individuals often lack access to meaningful social interactions, and that AI chatbots offer someone to talk to, which could eventually lead to dependency. One participant (ID 15, moderately lonely, score of 4) stated that "All people need someone to talk with, and for lonely people finding someone may be more difficult - hence they are more likely to turn to chatbots (…)" Another (ID 27, moderately lonely, score of 6) reasoned that "Because if they have no emotional support from people around them they will most likely depend to the thing that provides the most "support""

Another theme was the **ease of access** to AI chatbots, which makes them an especially convenient outlet for those seeking connection. As one participant (ID 25, not lonely, score of 0) noted, "The accessibility of AI chatbots enables lonely people to engage socially even if he/she has a limited social network." Others highlighted that this ease of access may be misleading, with one participant (ID 19, severely lonely, score of 11) pointing out that "It's easily accessible and gives the impression of having a real conversation (…)"

A third recurring theme was the **illusion of speaking to a real person**. Several participants emphasized how the human-like language and conversational style of AI chatbots may blur the line between artificial and human interaction, especially for lonely users. One participant (ID 38, moderately lonely, score of 3) explained that "Because the chatbot usually interacts in a human way that makes it seems like there is a caring person on the other end." Similarly, another (ID 50, not lonely, score of 0) noted that "Since the AI answer questions like a person would (in a conversational style) people could easily begin to use it as a conversation partner (…)"

Among the five severely lonely participants, four believed that lonely individuals may be at greater risk of becoming emotionally dependent on AI chatbots, and one answered "Maybe." Three of the four elaborated as to why, however there was no clear theme among these participants. One (ID 19, score of 11) said "It's easily accessible and gives the impression of having a real conversation, though there are limitations for how deep the conversations can get and how well it handles emotions". Another (ID 13, score of 9) simply stated that some may be "Turning to AI because of a lack of real connection with others." A third (ID 53, score of 8) reflected on the emotional effect, stating, "If it feels like it understands, it will have the same effect as a good friend and good friends are hard to come by."

5. Discussion

This study sets out to explore whether individuals who struggle with loneliness and social isolation may be considered a vulnerable group at risk of forming unhealthy attachments with AI chatbots and becoming dependent on them for emotional support and social interactions. This was done by comparing the types of interactions individuals with varying degrees of loneliness were comfortable engaging in with AI.

5.1 Interpretation of results

Although AI assistants such as Apple's Siri, Google Assistant, and Amazon's Alexa have been available longer than generative AI chatbots like ChatGPT, Bing Chat, and Replika, fewer participants reported experience with them. This is particularly noteworthy given that every iPhone has come with Siri pre-installed since 2011 (Apple, 2011).

The survey results showed that almost all respondents (94%) had experience with generative AI, and that 79% interacted with it several times per week. This showcases the rapid adoption of generative AI technologies, especially considering that ChatGPT, being the largest platform of generative AI platform, was launched less than three years ago. This isn't exclusive to university students either but also to those in the workforce as 42% of the survey respondents were employed. 94% of participants believed that lonely individuals might be at higher risk of developing unhealthy attachments with generative AI. Generative AI's ease of access, its ability to simulate human conversation and lonely individuals lack of social connections were the three most prevalent reasons given.

The survey study results did not show any significant differences between the answers from non-lonely participants and moderately lonely participants when comparing comfort asking factual, general life or intimate and personal questions. When severely lonely individuals were asked how comfortable they themselves would be to ask intimate and personal questions to an AI chatbot, they were significantly more comfortable to do so than both non-lonely and moderately lonely individuals. This suggests that loneliness may be a predictor of how individuals interact with AI chatbots, particularly in intimate and personal contexts.

This partially supports hypothesis 1 (H1), that the lonelier an individual is, the more comfortable they will be asking AI chatbots questions. This was the case for asking intimate and emotional questions (see Figure 9, however there was no significant difference in levels of comfort between the three groups of loneliness in asking non-personal factual questions or general life questions.

A strong positive correlation was found among severely lonely individuals between comfort in asking intimate and personal questions to AI chatbots and self-reported tech proficiency. This suggests that tech proficiency could play a role in whether certain individuals feel more comfortable engaging in intimate interactions with AI. However, this correlation was only present among severely lonely individuals, and no such relationship was observed for non-lonely or moderately lonely participants. This makes it less likely that tech proficiency is a general predictor of comfort with AI. Instead, tech proficiency may act more as a facilitator, enabling those who experience severe loneliness to engage more intimately with AI, rather than being a standalone factor.

Hypothesis 2 (H2), that participants' levels of comfort with asking questions will decrease as the questions require more intimate and personal information was partially correct. This was

the case for non-lonely and moderately lonely participants who were comfortable with asking non-personal factual questions, slightly less comfortable asking more general life questions and not comfortable asking intimate and personal questions. Severely lonely participants were less comfortable asking non-personal factual questions compared to general life or intimate personal questions. Although surprising, the difference was not statistically significant when compared with the results of non-lonely and moderately lonely participants.

Hypothesis 3 (H3), that the curve from comfortable to not comfortable will be skewed depending on the grade of loneliness was partially correct. Loneliness showed to be a factor predicting comfort however there was no clear curve to be observed for severely lonely participants.

Hypothesis 4 (H4), that socially lonely individuals will be more comfortable to ask personal and intimate questions and have a have a higher of AI acceptance than those who are emotionally lonely was partially true. Socially lonely participants had a significant higher AI acceptance score than emotionally lonely participants however they did not have a statistically significant higher comfort score asking. This may suggest that socially lonely individuals are more open to adopting new technologies that could help fulfil their need for social interaction, even if this does not translate into greater comfort with emotionally intimate exchanges.

Although statistically significant results were found, the low statistical power of this study due to its small sample size suggests that these findings should be acknowledged with caution.

The survey showed that 68.6% of participants believed that lonely individuals have a higher risk of becoming emotionally dependent on generative AI for emotional support and 25.5% believed that the risk might be higher. Out of the participants that believed the risk is higher, the most prevalent themes as to why was due to how generative AI has gotten to the point where it's able to communicate as well as humans. While generative AI may not be able to understand a person, it has become advanced enough so that over half of participants believe that AI chatbots could make them feel understood to a certain extent. It's ease of access was also something that many believed to be a large contributing concern, being able to access a chatbot from one's phone at any time for potentially no cost. Ease of access also ties into the most common elaboration as to why lonely individuals may be at a greater risk of becoming emotionally dependent on AI chatbots which is lack of alternatives. Many participants believed that lonely individuals may not have sufficient social connections in order to be able to reach out to satiate their needs for social connectivity. "All people need someone to talk with, and for lonely people finding someone may be more difficult - hence they are more likely to turn to chatbots" Participant ID 15.

These explanations, although they might not fully grasp the full extent of what the participants' reasonings were, can be linked to concerns brought up by clinical psychologist Catherine Lord, that generative AI used for emotional relief may serve as a form of self-treatment or escapism which might only exacerbate the issue instead of alleviating it (Wright, 2024).

The findings, that severely lonely participants were more comfortable asking intimate and personal questions to AI chatbots than both non-lonely and moderately lonely participants support these concerns. It shows that if someone who is severely lonely and feels the need for emotional support, that they are more likely to turn to an AI chatbot to satiate these needs as they are more comfortable asking AI chatbots intimate and personal questions such as "I'm

feeling lonely; can you talk to me". According to Franze et al. (2023), while chatbots might offer short-term comfort, they may also encourage avoidance of real-world relationships, and contribute to emotional dependency, particularly among individuals with social deficits.
The Parliament and Council of the European Union in 2024 enacted the AI Act which aims to protect Europeans from directly harmful and applications of AI and is meant to ensure that Europeans can trust what AI has to offer (European Commission, 2025). The AI Act bans systems that seek to exploit vulnerabilities which could be indirectly interpreted to cover certain cases of emotional manipulation however these systems are required to be designed with intent of being exploitative. There are no mentions of regulations that are instilled to protect Europeans from creating unhealthy relationships with AI, something that vulnerable groups with social deficiencies may fall victim of. This is noteworthy since the High-Level Expert Group on Artificial Intelligence, established by the European Commission, raises concerns about the psychological impact of AI systems. In their guidelines directed at developers of trustworthy AI, they pose the following questions:

> Could the AI system affect human autonomy by generating over-reliance by end-users?
> Did you put in place procedures to avoid that end-users over-rely on the AI system?
(AI HLEG, 2020, p. 7)

In addition, the guidelines raise concerns about how AI systems might u lead to addictive behaviour manipulating user behaviour:

> Does the AI system risk creating human attachment, stimulating addictive behavior, or manipulating user behavior?
> Depending on which risks are possible or likely, please answer the questions below:
> Did you take measures to deal with possible negative consequences for end-users or subjects in case they develop a disproportionate attachment to the AI System?
> Did you take measures to minimize the risk of addiction?
> Did you take measures to mitigate the risk of manipulation?
(AI HLEG, 2020, p. 8)

Concerns of over-reliance and addiction being acknowledged as something that ought to be avoided in when creating trustworthy AI highlight a regulatory gap in the AI Act (2024). The Act bans systems designed to exploit vulnerabilities related to age, disabilities, or specific social/economic situations but fails to mention lonely individuals at risk of becoming emotionally dependent and addictive to AI. The Act addresses systems that are intentionally designed to harm vulnerable groups, but it does not account for indirect psychological harms that may emerge through users' own patterns of interaction with AI systems.

Governments and other legislative bodies should act, because without proper regulation, companies may be incentivised to develop predatory AI chatbots that exploit users for monetary gain. This exploitation may not occur through the direct targeting of known vulnerabilities, but rather through the ways users interact with the AI. Instead of helping users overcome loneliness, such systems may reinforce harmful patterns of interaction leading to over-reliance on AI for emotional support and addiction.

The number of users turning to generative AI for emotional support is growing (Zao-Sanders, 2025). Unlike licensed healthcare professionals, who are ethically and legally obligated to act in the best interest of their patients, profit-driven AI companies are not held to the same standards. Instead, they may be incentivised to prioritise engagement and revenue, even if that

means capitalising on a user's emotional vulnerability. In the absence of appropriate legislation, there are few safeguards in place to protect users from such exploitation. Social media adoption serves as a cautionary tale of what can happen if potentially harmful technology isn't properly regulated. Social media usage has consistently been associated with symptoms of depression, anxiety, and psychological distress (Keles et al.,2019). Despite this it was widely adopted, potentially due to many were not being aware of the negative effects it could have. As more research is made on the subject, it is easier for more people to interact with it safely and be aware of how it may affect them. Regulations have been put in place by large legislative bodies such as the European Union and the Federal trade commission to protect vulnerable groups such as children from harmful interactions with social media. The European commission's Digital Services Act (2022) requires very large online platforms, online platforms and search engines with over 45 million users, to assess and mitigate systemic risks, including serious negative consequences to users' physical and mental well-being. This creates a regulatory foundation that obliges companies to consider how the design and functioning of their platforms may impact user health, and to take concrete steps to address those risks. These regulations make it so that platforms must audit how their algorithms, UX, and personalization features affect user well-being, including things like endless scrolling, algorithmic reinforcement of harmful content and addictive engagement loops.

Regulations need to be enacted for generative AI platforms that protect users from harmful interactions which could negatively impact their physical and mental well-being. Such regulations could require service providers to monitor for signs of unhealthy user habits, such as excessive reliance on the AI for emotional support. In these cases, the AI chatbot could be designed to suggest taking a break from interaction or, where appropriate, gently encourage the user to seek help from a mental health professional. Such features would serve as built-in safeguards to prevent the development of emotionally dependent or potentially harmful usage patterns.

5.2 Method Discussion

Replication of this study is necessary to support the findings and assess their reliability. One of the primary limitations of this study was the small sample size (N = 48), which may have negatively affected the study's internal validity as minor effects might have been observable with a larger sample size. The use of convenience sampling also means that this study is unlikely to be representative of the broader population. A sample size with a broader age group might show differences in how people of different ages interact with AI which was not possible in this study as the majority of participants were between the ages of 20-30 (75%), most being from Sweden. Even though the survey was conducted in English, cultural differences may have impacted the results.

This study used multiple non-validated instruments in the survey which calls into question construct validity. The cut-off points for categorizing loneliness were adjusted in this study to better fit the sample distribution. While this modification is methodologically defensible, it represents a deviation from the original guidelines of the De Jong Gierveld Loneliness Scale.

Participants completed the survey independently and without the researcher present. While this may have encouraged more honest responses by reducing social desirability bias, it also meant that participants were unable to ask clarifying questions if they were uncertain about the meaning of a particular item. Although this was taken into consideration when designing the survey, this may have introduced variability in how certain questions were interpreted.

This survey had only one open-ended question that allowed the participants to elaborate their answer. By adding more qualitative questions, responses might have revealed more nuanced insights into participants' thoughts, motivations, and concerns regarding AI companionship.

Further Research

This study had a limited sample size (N = 48), which reduces the statistical power and may have resulted in small effects going undetected while also calling into question the validity of the detected results. Therefore, replications of the study with larger and more diverse samples are needed to establish the reliability of the results and improve external validity. Future research should use random sampling instead of comfort sampling to better represent the general population.

Similar studies conducted in other countries could reveal potential cultural differences in how individuals interact with AI chatbots. This study was conducted in English at a Swedish university, therefore linguistic and cultural factors may have influenced participants' responses, especially regarding sensitive topics like loneliness and emotional comfort.

This study adapted the Almere model and created custom scenario-based questions to assess comfort with AI chatbots. While this allowed for relevance and specificity to generative AI, it also means that the comfort questions used were not part of a validated instrument. Future studies should either validate these instruments, develop new ones' or employ existing validated scales that measure emotional trust, perceived sociability, or human-likeness in AI which could offer greater comparability across studies.

The De Jong Gierveld Loneliness Scale enabled the study to distinguish between social and emotional loneliness, but existential loneliness was not included. Since existential loneliness is a distinct form of loneliness and may be influenced differently by interactions with AI (Ettema et al., 2010), future studies should consider including it as a measurable construct.

This study relied on participants' self-reported comfort levels in different scenarios; this approach has inherent limitations. Future research may benefit from directly observing interactions between lonely and non-lonely individuals with AI chatbots, to examine how these groups differ in practice rather than intention. Such research would likely require ethical approval however, as introducing lonely individuals to emotionally responsive AI could pose psychological risks as it may introduce them to an AI that the individual could form an unhealthy bond with.

Another consideration for future research is the modality of the AI used. This study focused on text-based generative AI but comparing it to an AI that delivers output via audio could reveal differing effects on user engagement, anthropomorphism, and emotional bonding. It is plausible that audio-based AI that simulate human speech could elicit an even stronger emotional responses than a text-based AI.

Since generative AI remains a relatively new technology for many users, longitudinal studies should be conducted to observe and examine how comfort, trust, and reliance on AI evolve over time. As AI becomes more integrated into everyday life, understanding both short and long-term effects of AI becomes increasingly important.

As generative AI becomes increasingly integrated into daily life, it is critical to examine not only the benefits but also its potential harms. The rapid adoption of these tools, coupled with their capacity to simulate empathy and emotional presence, creates a risk landscape that existing regulatory frameworks, including the 2024 AI Act, have yet to adequately address. Vulnerable individuals, such as those who struggle with loneliness, may be at particular risk of exploitation in the absence of safeguards. Unlike licensed mental health professionals, generative AI chatbots and the companies creating them are not bound by ethical obligations to act in the user's best interest. In a commercial context, companies may even be incentivized to sustain user engagement at the cost of user wellbeing. These findings underscore the urgent need for further research in the field of AI interactions and proactive policymaking to ensure that AI technologies are developed and deployed in ways that serve and protect, rather than exploit, the most vulnerable.

6. Conclusion

This study sought to explore whether loneliness can be used as a predictor for how individuals interact with generative AI chatbots and if lonely individuals may be a vulnerable group that could be exploited by AI. Although self-reported loneliness has not increased, social isolation has, exemplified by the phenomena of Hikikomori increasing. Social isolation may be increasing in part due to technological advancements, not requiring people to engage and rely on people around them for social connectivity as much anymore. Social media has allowed people to interact with each other regardless of physical distance, but social media usage has also been connected to mental health issues, although causation has not been able to be established. Despite this, large legislative powers attempt to regulate large online platforms to protect its users. With the rise of generative AI services such as ChatGPT, the rapid and largely unexamined adoption of social media serves as a cautionary tale. Social media's impact on users, both short-term and long-term, was not fully understood until after it became deeply embedded in everyday life. A similar pattern may now be unfolding with generative AI, whose psychological and societal effects remain largely unknown.

The findings of this study showed that individuals who were severely lonely were more comfortable to ask AI chatbots intimate and personal questions to AI chatbots than non-lonely and moderately lonely individuals. It also showed that socially people may be more accepting of AI than emotionally lonely individuals. This suggests that those who struggle with loneliness, who experience the need for social connectivity, may be more comfortable turning to an AI chatbot for emotional support.

As AI services become more common and advanced, it may become more common for people to seek emotional support and social connectivity from AI. For some it may serve as a helpful tool and supplement, but for others it may end up becoming a replacement for human interactions, potentially leading more people to become reliant on the AI chatbots for social connections and emotional support. Exclusively relying on AI chatbots for emotional support could lead individuals to form unhealthy relationships which instead of alleviating feelings of loneliness, could exacerbate them leading individuals to becoming further socially isolated from other people and feeling increasingly lonely.

Lonely people may be at greater risk of forming unhealthy attachments with AI and as such ought to be protected from actors looking to exploit their vulnerabilities and need for social connections. This underscores the need for further research, especially longitudinal studies, on how AI can impact individuals and highlights the lack of regulatory frameworks that address not only accuracy and safety, but also the emotional and psychological effects of AI systems.

References

Apple. (2003, April 28). *Apple launches the iTunes Music Store* [Press release]. https://www.apple.com/newsroom/2003/04/28Apple-Launches-the-iTunes-Music-Store/

Apple. (2011, October 10). *iPhone 4S pre-orders top one million in first 24 hours* [Press release]. https://www.apple.com/newsroom/2011/10/10iPhone-4S-Pre-Orders-Top-One-Million-in-First-24-Hours/

Barrett, P. M., Hendrix, J., & Sims, J. G. (2021). *Fueling the Fire: How Social Media Intensifies U.S. Political Polarization – And What Can Be Done About It*. NYU Stern Center for Business and Human Rights. Retrieved from https://bhr.stern.nyu.edu/wp-content/uploads/2024/02/NYUCBHRFuelingTheFire_FINALONLINEREVISEDSep7.pdf

BBC Newsround. (2019, March 12). *History of the CD: 40 years of the compact disc*. https://www.bbc.co.uk/newsround/47441962

Beckers, A., Buecker, S., Casabianca, E. J., & Nurminen, M. (2022). *Effectiveness of interventions tackling loneliness: A literature review* (EUR 31313 EN). Publications Office of the European Union. https://doi.org/10.2760/277109

Bhandari, P., & Nikolopoulou, K. (2023, June 22). *What is a Likert scale? | Guide & examples*. Scribbr. Retrieved May 14, 2025, from https://www.scribbr.com/methodology/likert-scale/

Cacioppo, J. T., & Patrick, W. (2008). Loneliness: Human nature and the need for social connection. W. W. Norton & Company.

Caulfield, J. (2023, June 22). *How to do thematic analysis | Step-by-step guide & examples*. Scribbr. https://www.scribbr.com/methodology/thematic-analysis/

Centers for Disease Control and Prevention. (2023). *The risk factors of social disconnection*. U.S. Department of Health & Human Services. https://www.cdc.gov/social-connectedness/risk-factors/index.html

Cox, D. A. (2021). *The state of American friendship: Change, challenges, and loss*. American Enterprise Institute. https://www.aei.org/wp-content/uploads/2021/07/The-State-of-American-Friendship.pdf?x85095

de Jong-Gierveld, J., & van Tilburg, T. G. (1999). *Manual of the Loneliness Scale. Methoden en technieken*. https://doi.org/10.17605/osf.io/u6gck

Durlauf, S. N. (2002). Bowling Alone: *A review essay. Journal of Economic Behavior & Organization*, 47(3), 259–273. https://doi.org/10.1016/S0167-2681(01)00210-4

Ettema, E. J., Derksen, L. D., & van Leeuwen, E. (2010). *Existential loneliness and end-of-life care: A systematic review. Theoretical Medicine and Bioethics*, 31(2), 141–169. https://doi.org/10.1007/s11017-010-9141-1

European Commission. (2022, October 27). *The EU's Digital Services Act*. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-services-act_en

European Commission. (2025, February 18.). AI Act: *Shaping Europe's digital future*. Retrieved May 20, 2025, from https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai

European Health and Digital Executive Agency. (2024, May 13). *European Mental Health Awareness Week: Horizon 2020 promotes natural spaces in cities to combat loneliness*. HaDEA. https://hadea.ec.europa.eu/news/european-mental-health-awareness-week-horizon-2020-promotes-natural-spaces-cities-combat-loneliness-2024-05-13_en

European Parliament and Council of the European Union. (2024). *Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations and Directives (Artificial Intelligence Act)*. *Official Journal of the European Union, L 202*, 1–222. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R1689

Federal Trade Commission. (2013, January 17). *Children's Online Privacy Protection Rule; Final Rule*. *Federal Register*, 78(12), 3972–4014. https://www.ftc.gov/system/files/2012-31341.pdf

Folkhälsomyndigheten. (2025, February 28). *Tillsammans minskar vi ensamhet*. Retrieved from https://www.folkhalsomyndigheten.se/livsvillkor-levnadsvanor/psykisk-halsa-och-suicidprevention/vad-gor-vi-och-andra/tillsammans-minskar-vi-ensamhet/

Franze, A., Galanis, C. R., & King, D. L. (2023). *Social chatbot use (e.g., ChatGPT) among individuals with social deficits: Risks and opportunities. Journal of Behavioral Addictions*, 12(4), 871–872. https://doi.org/10.1556/2006.2023.00057

General Data Protection Regulation. (2018, March 28). *Article 8 – Conditions applicable to child's consent in relation to information society services*. https://gdpr-info.eu/art-8-gdpr/

Gent, E. (2019, January 29). *The plight of Japan's modern hermits. BBC Future*. https://www.bbc.com/future/article/20190129-the-plight-of-japans-modern-hermits

Haasio, A., & Naka, H. (2019). An analysis of information shared on hikikomoris' discussion forums. *Qualitative and Quantitative Methods in Libraries, 8*(4), 509–523.

Hawkley, L. C., & Cacioppo, J. T. (2010). *Loneliness Matters: A theoretical and empirical review of consequences and mechanisms*. Annals of Behavioral Medicine, 40(2), 218–227. https://doi.org/10.1007/s12160-010-9210-8

Heerink, M., Kröse, B., Evers, V., & Wielinga, B. (2010). *Assessing Acceptance of Assistive Social Agent Technology by Older Adults: the Almere Model. International Journal of Social Robotics*, 2(4), 361–375. https://doi.org/10.1007/s12369-010-0068-5

High-Level Expert Group on Artificial Intelligence. (2020). *Assessment list for trustworthy artificial intelligence (ALTAI) for self-assessment*. European Commission. https://doi.org/10.2759/002360

Hiroshi Yamazoe : Hikikomori. (2021, September 21). *Hikikomori and Money: Financial Independence is Possible!* [Video]. YouTube. https://www.youtube.com/watch?v=6zd7DJuiPPk

Hoffman, M. (2011, October 9). *Nonprofits in Japan help 'shut-ins' get out into the open.* The Japan Times Online. https://www.japantimes.co.jp/news/2011/10/09/national/nonprofits-in-japan-help-shut-ins-get-out-into-the-open/

Itou, Junichirou (2003). *Guideline on Mental Health Activities in Communities for Social Withdrawal* (in Japanese). Tokyo: Ministry of Health, Labor, and Welfare.

Kannan, V. D., & Veazie, P. J. (2022). *US trends in social isolation, social engagement, and companionship −nationally and by age, sex, race/ethnicity, family income, and work hours*, 2003–2020. SSM - Population Health, 21, 101331. https://doi.org/10.1016/j.ssmph.2022.101331

Keles, B., McCrae, N., & Grealish, A. (2019). A systematic review: The influence of social media on depression, anxiety and psychological distress in adolescents. *International Journal of Adolescence and Youth, 25*(1), 79–93. https://doi.org/10.1080/02673843.2019.1590851

Kemp, S. (2024, January 31). *Digital 2024: Global overview report*. DataReportal – Global Digital Insights. https://datareportal.com/reports/digital-2024-global-overview-report

King, M. L., Jr. (1964, December 11). *The quest for peace and justice* [Nobel lecture]. NobelPrize.org. https://www.nobelprize.org/prizes/peace/1964/king/lecture/

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction: A review of the psychological literature. *International Journal of Environmental Research and Public Health, 8*(9), 3528–3552. https://doi.org/10.3390/ijerph8093528

Laestadius, L., Bishop, A., Gonzalez, M., Illenčík, D., & Campos-Castillo, C. (2022). Too human and not human enough: A grounded theory analysis of mental health harms from emotional dependence on the social chatbot Replika. *New Media & Society*, *1–19*. https://doi.org/10.1177/14614448221142007

Marikyan, D., & Papagiannidis, S. (2023). Unified theory of acceptance and use of technology: A review. In S. Papagiannidis (Ed.), *TheoryHub Book*. https://open.ncl.ac.uk (ISBN: 9781739604400)

Odgers, C. L., & Jensen, M. R. (2020). Annual research review: Adolescent mental health in the digital age: Facts, fears, and future directions. *Journal of Child Psychology and Psychiatry, and Allied Disciplines, 61*(3), 336–348. https://doi.org/10.1111/jcpp.13190

Office of the U.S. Surgeon General. (2023). *Our epidemic of loneliness and isolation: The U.S. Surgeon General's advisory on the healing effects of social connection and community*.

U.S. Department of Health and Human Services. https://www.hhs.gov/sites/default/files/surgeon-general-social-connection-advisory.pdf

Office of the Surgeon General. (2023). *Social media and youth mental health: The U.S. Surgeon General's advisory*. U.S. Department of Health and Human Services. https://www.ncbi.nlm.nih.gov/books/NBK594759/

O'Neill, A. (2024, August 9). *Japan: Total population from 1800 to 2020*. Statista. Retrieved May 15, 2025, from https://www.statista.com/statistics/1066956/population-japan-historical/

Pelusi, M. (2023). *Napster released*. EBSCO Research Starters. Retrieved May 21, 2025, from https://www.ebsco.com/research-starters/computer-science/napster-released

Pozza, A., Coluccia, A., Kato, T., Gaetani, M., & Ferretti, F. (2019). The 'hikikomori' syndrome: Worldwide prevalence and co-occurring major psychiatric disorders: A systematic review and meta-analysis protocol. *BMJ Open, 9*(9), e025213. https://doi.org/10.1136/bmjopen-2018-025213

Rosson, M. B., & Carroll, J. M. (2002). Scenario-based design. In J. A. Jacko & A. Sears (Eds.), *The human-computer interaction handbook: Fundamentals, evolving technologies and emerging applications* (pp. 1032–1050). Lawrence Erlbaum Associates.

Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*. Simon & Schuster.

Spotify. (2024). *About Spotify*. Spotify Investor Relations. Retrieved May 21, 2025, from https://investors.spotify.com/about/

Statistics Bureau of Japan. (2024, April 22). *Population estimates as of April 1, 2024 (Provisional estimates)*. https://www.stat.go.jp/data/jinsui/pdf/202404.pdf

Stip, E., Thibault, A., Beauchamp-Chatel, A., & Kisely, S. (2016). Internet addiction, hikikomori syndrome, and the prodromal phase of psychosis. *Frontiers in Psychiatry, 7*, Article 6. https://doi.org/10.3389/fpsyt.2016.00006

Semrush. (2025, May 13). *Top websites in the world – April 2025: Most visited & popular rankings*. https://www.semrush.com/website/top/

Tan, K. W. K. (2025, May 13). *The way you use ChatGPT can show your age, Sam Altman says*. *Business Insider*. https://www.businessinsider.com/sam-altman-people-use-chatgpt-differently-depending-age-2025-5

Teo, A. (2012, November 8). *Modern-day hermits: The story of hikikomori in Japan and beyond* [Video]. University of Michigan Center for Japanese Studies. https://www.youtube.com/watch?v=70bv5gaN4LI

Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. The MIT Press.

Wright, W. (2024, June 5). *Why autistic people seek AI companionship*. *Scientific American*. https://www.scientificamerican.com/article/why-autistic-people-seek-ai-companionship/

Zao-Sanders, M. (2025, April 9). *How people are really using gen AI in 2025*. *Harvard Business Review*. https://hbr.org/2025/04/how-people-are-really-using-gen-ai-in-2025

Appendix

Appendix A

Supplementary Tables

Table A19

Shapiro-Wilk Normality Test for Loneliness Groups comparisons

	W	p
Ai Acceptence	0.975	0.378
Factual questions	0.918	0.003
General life questions	0.963	0.132
Intimate questions	0.841	<.001

Note. A low p-value suggests a violation of the assumption of normality

Table A20

Levene's Homogeneity of Variance Test for Loneliness Groups comparisons

	F	df1	df2	p
Ai Acceptence	0.594	2	45	0.556
Factual questions	1.471	2	45	0.241
General life questions	0.517	2	45	0.600
Intimate questions	0.211	2	45	0.811

Table A21

Shapiro-Wilk Normality Test for Loneliness Groups comparisons

	W	p
Tech proficiency	0.950	0.039

Note. A low p-value suggests a violation of the assumption of normality

Table A22

Levene's Homogeneity of Variance Test for Loneliness Groups

	F	df1	df2	p
Tech proficiency	0.543	2	45	0.585

Note. A low p-value suggests a violation of the assumption of normality

Table A23

Pearson's r comparisons for Non-Lonely participants

		Gender	Age	Tech proficiency
Intimate questions	Pearson's r	0.039	0.071	-0.052
	df	19	19	19
	p-value	0.865	0.758	0.822

Table A24

Pearson's r comparisons for moderately lonely individuals

		Gender	Age	Tech proficiency
Intimate questions	Pearson's r	-0.384	-0.050	0.100
	df	20	20	20
	p-value	0.077	0.826	0.658

Table A25

Shapiro-Wilk Normality Test for Social and Emotional Comparisons

	W	p
Ai Acceptence	0.971	0.647
Factual questions	0.913	0.031
General life questions	0.924	0.055
Intimate questions	0.861	0.002

Note. A low p-value suggests a violation of the assumption of normality

Table A26

Levene's Homogeneity of Variance Test for Social and Emotional Comparisons

	F	df1	df2	p
Ai Acceptence	2.17e-4	1	24	0.988
Factual questions	0.457	1	24	0.506
General life questions	0.120	1	24	0.732
Intimate questions	3.750	1	24	0.065

Note. A low p-value suggests a violation of the assumption of normality

Appendix B

Survey Instrument

Note. This contains the full survey distributed to participants, including the consent form and all items presented in order.

Survey Title: Survey on AI Chatbots and Loneliness

Purpose of the Study
This survey is part of a bachelor's thesis in Cognitive Science at Linköping University. The study investigates the relationship between people's perceptions of AI chatbots and their perceived loneliness. It focuses on how individuals interact with AI chatbots and the factors that influence their trust in these systems.

Duration
The survey takes approximately 10–15 minutes to complete. Please ensure you have time to finish without interruptions.

Participation and Voluntariness
Your participation is entirely voluntary. You may withdraw at any time without providing a reason or facing any consequences. If you withdraw, no additional data will be collected.

Data Protection and Personal Data Processing
This study complies with the EU General Data Protection Regulation (GDPR). Your personal data will be handled responsibly and anonymously.

Contact Information
Student researcher: danja465@student.liu.se
Supervisor: hannah.pelikan@liu.se

By clicking “I consent,” you confirm that:
- You have read the information above and understand the purpose of the study.
- You voluntarily agree to participate in the study.
- You are aware that you can withdraw your consent at any time.
- You consent to participate and to the processing of your data as described above.

☐ I consent

Section 1: Demographic and Background Questions
1. What is your gender?
   - Woman
   - Man
   - Non-binary
   - Prefer not to say

2. What is your age? (Please enter a number)

3. What is your primary daily occupation?
- Unemployed
- Retired
- Student
- Employed

4. What is your primary country of residence over the past 5 years? (Open-ended)

5. How would you rate your tech proficiency?
- Poor
- Below average
- Average
- Good
- Very good

6. Have you ever used an AI assistant (e.g., Siri, Google Assistant, Alexa)?
- Yes
- No, but I'm aware of them
- No
- I don't know

7. For how long have you been using an AI assistant?
- Less than 6 months
- 6 months to 1 year
- 1 to 3 years
- More than 3 years
- I don't remember
- I don't use them

8. How often do you use an AI assistant?
- Multiple times a day
- Once a day
- A few times a week
- A few times a month
- Rarely
- I don't use them

9. Have you ever used an AI chatbot that can be conversed with (e.g., ChatGPT, Bing Chat, Replika)?
- Yes
- No, but I'm aware of them
- No
- I don't know

10. For how long have you been using AI chatbots?
- Less than 6 months
- 6 months to 1 year
- 1 to 3 years
- More than 3 years

- I don't remember
- I don't use them

11. How often do you use AI chatbots?
- Multiple times a day
- Once a day
- A few times a week
- A few times a month
- Rarely
- I don't use them

12. What do you primarily use AI chatbots for? (Select all that apply)
- Factual information (e.g., definitions, trivia)
- Everyday tasks (e.g., reminders, recipes)
- Work/study (e.g., writing, research)
- Social interaction (e.g., chatting for fun, emotional support)
- I don't use them

13. How easy is it to interact with AI chatbots?
- 1 – Very difficult
- 2
- 3 – Fair
- 4
- 5 – Very easy

Section 2: AI Acceptance Questions

Instructions: Please indicate your response on a scale from 1 (Not at all) to 5 (Very much).

14. How much would you trust AI chatbots to explain how they generate their answers?
15. How useful do you think AI chatbots are for providing accurate and helpful responses?
16. How much do you trust AI chatbots to give you correct information?
17. If an AI chatbot gave you advice that conflicted with a human expert's opinion, how likely would you be to trust the AI?
18. How much do you trust AI chatbots to keep your personal information private?
19. Would you feel judged by others if they knew you used an AI chatbot?
20. Do you think using AI chatbots is socially acceptable?
21. How much do you feel AI chatbots can engage in conversation like a human?
22. Do you think AI can give the impression of understanding human emotions?
23. Do you think that an AI can understand human emotions?

Section 3: Loneliness Scale (De Jong Gierveld)

Instructions: Please indicate how often each statement applies to you.

Response options: None of the time, Rarely, Some of the time, Often, All of the time.

24. There is always someone I can talk to about my day-to-day problems
25. I miss having a really close friend
26. I experience a general sense of emptiness

27. There are plenty of people I can lean on when I have problems
28. I miss the pleasure of the company of others
29. I find my circle of friends and acquaintances too limited
30. There are many people I can trust completely
31. There are enough people I feel close to
32. I miss having people around me
33. I often feel rejected
34. I can call on my friends whenever I need them

Section 4: AI Trust and Comfort Questions

Instructions: Please indicate your comfort level on a scale from 1 (Not Comfortable) to 5 (Very Comfortable).

35. How comfortable would you be to ask an AI chatbot how tall the Eiffel Tower is?
36. How comfortable would you be to ask an AI chatbot who the main character is of a movie?
37. How comfortable are you relying on an AI chatbot to remind you of an upcoming deadline?
38. How comfortable would you be to have an AI chatbot remind you of a doctor's appointment?
39. How comfortable would you be in asking an AI chatbot to help you with a work or study assignment?
40. How comfortable are you asking an AI chatbot for help with work or study-related tasks?
41. How comfortable would you be discussing general life dilemmas with an AI chatbot?
42. How comfortable are you asking an AI chatbot for advice on social or personal relationships?
43. How comfortable are you sharing personal emotions with an AI chatbot?
44. How comfortable are you having an AI chatbot as a source of emotional support?
45. How comfortable are you in considering an AI chatbot as something more than just a tool?

Section 5: Attitudes and Perceptions

46. What do you view AI chatbots as? (Select all that apply)
  - A purely functional tool
  - A helpful assistant
  - A conversation partner
  - Something more personal
  - Other: _____

47. If a chatbot and a friend gave you conflicting advice, which would you be more likely to follow?
  - 1 – Only the friend's advice
  - 2
  - 3 – Both equally
  - 4
  - 5 – Only the AI chatbot's advice

48. How likely are you to turn to an AI chatbot for emotional support?
  - 1 – Not likely
  - 2

- 3 – Somewhat likely
- 4
- 5 – Very likely

49. Do you think an AI chatbot could make you feel understood?
- 1 – No
- 2
- 3 – Somewhat
- 4
- 5 – Yes

50. Do you think that lonely individuals are more at risk of becoming emotionally dependent on AI chatbots?

- Yes
- No
- Maybe

51. If yes, can you explain why? (Open-ended)

52. If there's anything else on this topic you'd like to mention, you can write it here: (Open-ended)