Master Thesis

Master’s programme in Digital Service Innovation (120 credits)

Exploring the Role of Virtual Companions in Alleviating Loneliness Among Young Adults

Informatics (30 credits)

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Abstract. Loneliness among young adults has risen over the past years and today around 62% of young adults say they have been or are negatively affected by it (Stickley & Koyangi, 2016). This can lead to depression, anxiety but in the worst case addiction, self-harming or suicidal thoughts. This study examines how AI-based interventions, such as virtual companions, can be designed and implemented to reduce loneliness among young adults. By exploring the possibilities and challenges of the design and development of creating an AI companion. This study uses a systematic literature study and semi-structured interview based on 20 participants. The semi-structured interview was then analyzed with a thematic analysis. Which then was visualized with a concept map. The findings of the study presents four themes: “Empowering Loneliness Combat with AI”, “Treading the Thin Line of Human-like AI”, “Irreplaceable Human Connection” and “Nurturing Trust in the AI Ecosystem”. With this knowledge that this study presents, it can help support the knowledge needed to design and develop an AI companion to ease loneliness in young adults.

Key words: AI companion, Mental health, Loneliness, Young adults and AI based intervention
1 Introduction

Loneliness is a universal and human experience and is defined by the personal feeling of being isolated or alone (Stickley & Koyangi, 2016). It doesn't matter if the person in question is surrounded by people. It is a complex feeling that can be affected by many different factors like feeling a deficiency of close relationships, social isolation, or feeling disconnected from people, friends, family, or other social relationships (Hu et al., 2021). Loneliness can have harmful effects on mental and physical health, especially among young adults, who are in a transition phase in life and may experience significant changes in their social networks (Morrish, Mujica-Mota & Medina-Lara., 2022).

The development of new technologies such as artificial intelligence (AI) creates possibilities to create services that can help ease loneliness among young adults. For instance, virtual companions, also called chatbots, could help these young adults with a sense of social connections and companionship, even if they are physically isolated.

Although prior literature has recognized the importance of virtual companions in everyday assistance, most literature focuses on virtual companions in the context of the elderly or in other forms of care such as in dealing with dementia for the elderly (Ryu et al., 2020; Liu, Chuang, & Chen, 2018). Relatively little literature focuses on how virtual companions can provide support to young adults dealing with the negative aspects of loneliness. With the technology found in today's mobiles, it is possible to map the mood of young adults with their approval and create communication with the user to encourage healthy behavior (Rashid et al., 2020).

Addressing loneliness among young adults is important, as loneliness can lead to several different negative effects on their health, both psychologically and physically. For example, depression, anxiety, and poorer quality of life. In the worst situations, it can also lead to self-harming behavior or substance abuse (Horigian et al., 2021). Exploring the potential of AI and how it can help address loneliness among young adults, can provide effective help to promote mental health among young adults. This research is guided by the following research question: How can AI-based interventions, such as virtual companions, be designed and deployed to reduce loneliness among young adults? And aims to explore the potential of AI-based interventions in loneliness among young adults.

Examining the literature on loneliness and virtual companions also examines the design and implementation, and implementation strategies of virtual companions and their effectiveness in reducing loneliness among young adults. Chatbots or virtual assistance have been used in other forms of care, such as elderly care, which have proven to be effective in the care of dementia (Ryu et al., 2020).

2 Literature review

This chapter begins with literature on loneliness among young adults and how this is a problem among young adults, and what are the effects of loneliness in this age group. Later, it focuses on research on how different virtual companions and other digital services have provided help to users' mental health.

2.1 Loneliness Among Young Adults

Loneliness is a normal feeling to have when you are a young adult, and it is a subject that is growing in research over the last few years. A study from 2016 presented that 62.5% of young adults have
experienced loneliness (Stickley & Koyangi, 2016). The effects of loneliness among young adults are linked to an increased risk of anxiety, depression, and poorer physical health (Qualter et al., 2015). According to UCLA, which is a scale for how to measure loneliness. There has been an increase among young adults in the last 40 years (Buecker et al., 2021). And according to Buecker and colleagues (2021) this is not only a serious health risk for the individual, but also a societal problem.

In another study on young adults and loneliness, a link was seen between increasing the use of social media among young adults and loneliness (Bonsaken et al., 2023). This study was done based on its measurement of loneliness on "The loneliness scale" created by Jong Giervald and Van Tilburg in 2006. Where, based on six statements, people rate from 0 to 4, 0 does not agree and 4 completely agrees. This scale can be used in two different ways, social loneliness, and emotional loneliness. Social loneliness is based on people around you and how you feel, and emotional loneliness is based on the support you feel you get or not, around emotions (Bonsaken et al., 2023). A connection has also been seen between loneliness and young adults who "binge-watch" TV series and films with high frequency (Starosta, Izydorczyk & Lizińczyk, 2019). Binge-watching is when an individual watches a TV series or movies for several hours, in one sitting. Where it is seen that "binge-watching" can function as a form of coping with loneliness and an escape from reality (Starosta, Izydorczyk & Lizińczyk, 2019).

A connection has also been found in that unemployment and being isolated from a community are influencing factors that create loneliness among young adults (Morrish, et al., 2022). Young adults that are unemployed and/or feel disconnected from their community, can be so negatively affected that both their mental and physical health deteriorates (Morrish, et al., 2022).

Loneliness should not belong to a certain age group, but it is something that dynamically follows a person throughout their life, it does not necessarily increase with older age (Beam & Kim, 2020). The authors continue in the same text by saying that people who are older than 70 years have a higher risk of experiencing loneliness, so it is adolescents and young adults who are most affected by it (Beam & Kim, 2020).

Loneliness is often directly linked to social isolation and is something that is a well-written topic, especially with the COVID 19 pandemic so close to our lives and experiences. Where research has presented how social isolation has affected young adults with increased addiction, depression, anxiety, and stress as a result (Clair, Kroon & Reilly, 2021; Horigian, Schmidt & Feaster, 2021; Okruszak et al., 2020).

However, Lay et al. (2019) say in their research that loneliness should not only be seen in a general way as negative, but it is something very individual. Factors such as how the individual's social competence, communication skills, and secure attachment style influence how the individual perceives loneliness. For some individuals, loneliness can be experienced as positive and be a way to self-reflect, feel calm, and recover. While other individuals experience that discomfort and do not want to be alone with their own thoughts.

Loneliness in adults is based on their life experiences, and it is important to seek help if you feel that it affects you so negatively that your quality of life deteriorates. Matthews et al. (2019) claims that loneliness is distributed equally across gender and socio-economic backgrounds. Young adults who feel bad about loneliness have often experienced social isolation as children, had mental health
problems, or been bullied, and these experiences accompany growing up and later in life (Moretta, Franceschini, & Musetti, 2023). Even if loneliness is distributed equally among women and men, it can be seen that men with poorer sleep quality are more negatively affected by loneliness than men with good sleep quality. This sleep disorder can be linked to metabolic and hormonal problems (Moretta, Franceschini, & Musetti, 2023). It can also be seen that women experience emotional loneliness more than men and that men experience more social loneliness than women among young adults (von Soest, Luhmann, & Gerstorf, 2020).

2.2 AI-Based Interventions

There is a long history of integrating technological innovations and digital services in the health domain. For example, earlier studies in the use of technology in the health domain focused on telemedicine and remote patient monitoring (RPM) which is when you monitor the well-being of patients outside the clinical settings to monitor and manage the patient's well-being (Pathak et al., 2023). This later shifted to a spectrum of alternatives in digital services and tools to provide support to users with mental health (Sweeney et al., 2021). For example, Chatbots or virtual companions are one of these services, and they can, with machine learning and artificial intelligence, communicate with the user via voice and text calls. For example, they are helping the user with cognitive behavior therapy (Thieme et al. 2023). This can reduce symptoms of depression and anxiety (Sweeney et al., 2021). Another example of using chatbots is that it helps users with motivation and productivity by providing them with relevant information or support (Sweeney et al., 2021). The collection of data from the user's mood and behaviors helps users understand and provide more in depth care and aid (Liu et al., 2021). For example, a mobile data collector could facilitate the user's ability to update situations and which can complement their care together with a clinic (Rashid et al., 2020). By giving the users tools to reflect and evaluate. However, the way of expressing oneself may be limited to how the user should evaluate their mood, which can make it difficult for the user to express themselves (Abtahi et al., 2020). Even so, there is a model for an AI that should help mainly elderly people and disabled people with loneliness. By offering emotional support and communicating with a natural language, being able to respond to the user's preferences and adapt to that particular individual (Sullivan et al., 2023). However, this is only a model and not a service but the authors see the possibility of its utility in various health services (Sullivan et al., 2023).

Chatbots have been used in healthcare for dementia care by monitoring the patient's daily well-being, being able to treat the patient with the right kind of treatment to stimulate their brains with various activities such as memory games or alphabets. This has been seen to be rewarding for the patients as anxiety, depression, and stress have decreased (Ryu et al., 2020). But the help of AI in mental health care has also been seen as beneficial for its users by being able to offer support and help all around the clock, but also easier opportunities to seek help and receive support. It also provides value in being able to support people with geographical problems who do not as easily get help locally. It can also facilitate giving support to people who feel affected by the stigma surrounding mental health (Sweeney et al., 2021). A problem that can arise with virtual companions, however, is their way of perceiving human language and how complex it is. This can lead to obscure or inappropriate responses from virtual companions (Sweeney et al., 2021).

Since mental health is also a sensitive area, it is important to think that professional workers in mental health should not be replaced by the various forms of therapy that are offered, but should be seen as an opportunity to use as a tool for their therapy (Sweeney et al., 2021). An example of how
to implement digital tools in mental health care for young people is to be able to express yourself with different emojis via a website. This can then be done in an environment that one then feels safe in or in dealing with a situation that requires reflection on the user's mental health. The patient then takes this with him to the next call with a special list within mental healthcare and can discuss it further. (Patrício, Grenha Teixeira and Vink, 2019). This also gives the clinic the opportunity to improve its clinic and its practice at work to create better mental health in society (Patrício, Grenha Teixeira and Vink, 2019). It is also a good way to reach more people and help them with important and correct information about mental health (Calcan & Holmes, 2021). It is important in the creation of a service or digital tool that will help with mental health to involve people who are knowledgeable in mental health, to create something that can help. It is also important to take part in the knowledge and experience of people with mental health problems to ensure that their voice is heard. To create a service that considers ease of use from their perspective (Carr 2020).

When using AI in healthcare, it is important to also understand the ethical aspects that come with AI and the data that is collected (Morley et al. 2020). In order to respond to this correctly, Morley et al. (2020) and her colleagues created these three categories; Responsibility and accountability, which focus on who is responsible for decisions by the AI system. Are there different interests that can harm. The second is transparency and openness. This is about understanding the AI system, how it works, and what data is used to make decisions. This is important in the aspect of assessing correctly and reliably. The last one is Fairness and rights, this is emphasized in order not to give privilege to some but to be able to respond in a way that treats the individual from their perspective.

It is important to have an open and critical dialogue when discussing and creating AI-based services in healthcare and mental health care in order to guarantee a responsible and ethical good service (Carr 2020). Data collection is a recurring discussion that arises within AI-based services in mental health care. It is an important discussion to have, as the user's privacy and confidentiality must be protected (Sullivan et al.,2023).

Tinwell. et al (2011) describe a negative effect called the "uncanny valley", which means that the user interacts with an artificial character that looks almost lifelike, but that something feels uncomfortable about it. This can lead to fear or lose interest in it but keeps going and stops interacting with it. To avoid that users do not become uncomfortable or uncomfortable when they interact with an artificial figure such as in an AI companion e.g. if they are important, you can follow Tinwell. et al., (2011) design guidelines that produced various advice to avoid this effect. This advice involves, among other things, creating facial features in the characters that are more cartoonish still helps to eliminate the unpleasant ones and you perceive the characters with positives (Tinwell et al., 2011)

The manuscript is to be written in English. It is the responsibility of the author to use proper English. If necessary, use the software Grammarly and the student service academic writing support. Manuscripts with frequent spelling errors or linguistic mistakes can be failed for not fulfilling academic writing criteria.

3 Method

This study investigated How can AI-based interventions, such as virtual companions, be designed and deployed to reduce loneliness among young adults. By using Hevners "A three cycle view of
I want to create an efficient and useful AI based intervention that serves as a tool to help young adults with loneliness. And also contribute with knowledge of how AI-based interventions can be used to improve mental health and well-being. The model consists of three cycles, the Relevance cycle, which collects an understanding of the problem and what the needs are (Hevner, 2007). In the second cycle, the Rigor cycle. The focus is on the design solution and prototypes that are tested and it provides grounded theories and generates research to the knowledge base (Hevner, 2007). The third cycle, called the design cycle, reflects on the results, the knowledge contribution, and the process (Hevner, 2007). Below is how the three different cycles are implemented in this study. Table 1 visualizes how these different cycles will be present in this study.

### 3.1.1 Relevance cycle

This step involves identifying the problem, the target group, and the relevant theory (Hevner, 2007). In this case, the negative aspects of young adults' psychological and physical well-being related to loneliness were identified. Also, theories about loneliness among young adults and how AI-based interventions can be used to improve the well-being of young adults.

### 3.1.2 Rigor cycle

This cycle focuses on creating a concept and designing an AI based intervention, a form of virtual companion which can support and help the loneliness of young adults. In this cycle, a plan is also planned for how the service will help these users and in this also how it will be tested, and what criteria the service must meet to help young adults with loneliness.

### 3.1.3 Design cycle

Evaluates the results from the previous cycle and reflects on how the AI-based intervention can be developed and improved. This step also requires an assessment of the knowledge that emerged during the testing and how it can contribute to knowledge in how AI-based interventions can help with loneliness in young adults. This cycle is about identifying opportunities for iteration of the study, but also for future studies in this research area (Hevner, 2007).

<table>
<thead>
<tr>
<th>Cycle</th>
<th>Description</th>
<th>Methods</th>
</tr>
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</table>
| The Relevance cycle    | • Identifying research problem, loneliness among young adults and AI based interventions.  
                          | • collect relevant literature about loneliness among Young adults and AI based interventions.  
                          | • Explore how to reduce loneliness among young adults using AI-based interventions | • Literature review          |
3.2 Literature review

The literature review describes Loneliness Among Young Adults & AI-Based Interventions. Two databases have been used to conduct the literature review, Google Scholar, and Scopus. To organize this literature review, I followed Levy and Ellis (2006) framework of a systematic literature review. The framework consists of three stages: Input is about identifying relevant sources, setting criteria for your search, and defining your research question in the literature (Levy & Ellis, 2006). Processing is about reading articles, analyzing the content and organizing the content according to different themes. In this step, critical assessments and summaries are also carried out to develop a theoretical framework (Levy & Ellis, 2006). Output: In this stage, you create a coherent text where you show how all the research is connected to the research question (Levy & Ellis, 2006). Following this framework supports the researcher in finding relevant research, analyzing it, and drawing a clear conclusion (Levy & Ellis, 2006).

3.2.1 Input

I divided my research into two parts, Loneliness Among Young Adults and AI-Based Interventions. To find relevant material in the two different areas by putting my desired criteria in the filter that the database offered. (Levy & Ellis, 2006). The criteria I used in my research on the two parts were language, English, Swedish and Danish. Publication year between 2019 and 2023 to get as relevant knowledge as possible (Patel & Davidson, 2011). Criteria that were only used within Loneliness Among Young Adults were in the subject areas: Psychology, Sociology, Arts, Health profession, and Business. While I expanded the criteria for AI-based interventions to also Engineering and Computer Science. In choosing and selecting relevant literature, I started by reading the title and the abstract. If the information in the literature seemed to fit my topic, I saved the article. If not, I moved on to the next article.

3.2.2 Processing

By reading through all the literature I collected, I summarized the literature with a critical perspective and was able to thematize the various articles into different themes. To get a more comprehensive understanding of the knowledge, I gathered. A backward search was also used in

| The Rigor cycle | • Identify and evaluate relevant literature on loneliness among young adults and AI based interventions • Conduct interviews with 20 participants • Identify patterns and themes by analyzing the data collected during interviews | • Systematic literature review • Semi-structured interviews • Thematic analysis |
| The Design cycle | • Visualize connections between the different themes and elements based on the literature review and the thematic analysis • Draw conclusions and propose design solutions based on the results | • Concept Mapping |

Table 1. Hevner et al., (2007) research cycles and description
the case of articles that were particularly interesting or that I noticed that the literature referred to a particular author many times.

3.2.3 Output

When the compilation of the articles' themes was done, the knowledge gained in the two different parts were presented in Loneliness Among Young Adults and AI-Based Interventions. To create a clear and clear conclusion about the research question (Levy & Ellis, 2006).

3.3 Interviews

The empirical data in this study consists of semi-structured interviews with 20 participants, aimed to explore the potential of AI based interventions to reduce loneliness among young adults. The interviews were done online via google meet, before the recordings of the interviews began, the participants were introduced to the topic, the research question and informed of the rights in this study. When I got everyone's consent to record the interviews before I started recording. The reason for choosing to use a semi-structured interview was to be able to ask open questions, which in turn leads to the participants being able to express their thoughts and opinions in a free form without feeling restricted (Patel & Davidson, 2011).

In the creation of my questions, I decided to divide it into four different sessions to create an overall picture, ice breakers, and easier questions to create self-confidence in the participant. So that they would then feel secure with the more profound questions within, Loneliness, AI-based Intervention, and design of the service. The interviews were booked and planned to be around 45 minutes, but depending on the different participants, it took between 30 and 50 minutes. Before each interview, each participant was welcomed with some small talk to create a calm and relaxed interview. I considered this to be particularly important as many of the participants were not used to being interviewed in English. And I wanted everyone to feel safe to share such experiences and opinions.

Of the 20 participants I interviewed, 16 of them have a connection to an ideal group for students in Kristianstad, this ideal group creates open events for students such as parties, barbecues, and similar events to encourage students who feel lonely to dare meet new people and friends. As a new student, you can feel lonely in a new city. Therefore, I think it is interesting to get their opinions and experiences in my research. All 20 participants have a background in either pedagogy, healthcare, or IT. This can offer unique and valuable insights into how AI-based interventions for loneliness among adults and how it can be implemented. The 20 participants have an age range between 22 to 32. As it creates a scale in the group between different perspectives from those who have recently become young adults and people who have recently been young adults, who can reflect on their experiences. In the table below, all participants are presented anonymously with their background, age, and how long the interview lasted.
<table>
<thead>
<tr>
<th>Participant id</th>
<th>Interview length</th>
<th>Age</th>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>47 min</td>
<td>28</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P2</td>
<td>31 min</td>
<td>32</td>
<td>IT</td>
</tr>
<tr>
<td>P3</td>
<td>32 min</td>
<td>24</td>
<td>IT</td>
</tr>
<tr>
<td>P4</td>
<td>31 min</td>
<td>24</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P5</td>
<td>35 min</td>
<td>24</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P6</td>
<td>44 min</td>
<td>24</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P7</td>
<td>30 min</td>
<td>24</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P8</td>
<td>42 min</td>
<td>22</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P9</td>
<td>35 min</td>
<td>25</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P10</td>
<td>42 min</td>
<td>32</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P11</td>
<td>32 min</td>
<td>28</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P12</td>
<td>28 min</td>
<td>22</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P13</td>
<td>48 min</td>
<td>25</td>
<td>IT</td>
</tr>
<tr>
<td>P14</td>
<td>43 min</td>
<td>28</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P15</td>
<td>35 min</td>
<td>27</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P16</td>
<td>35 min</td>
<td>23</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P17</td>
<td>31 min</td>
<td>28</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P18</td>
<td>42 min</td>
<td>23</td>
<td>Healthcare</td>
</tr>
<tr>
<td>P19</td>
<td>37 min</td>
<td>26</td>
<td>Pedagogy</td>
</tr>
<tr>
<td>P20</td>
<td>41 min</td>
<td>28</td>
<td>IT</td>
</tr>
</tbody>
</table>

*Table 2. Presentation of the participants of the semi structured interviews*
3.4 Thematic Analysis

To analyse the empirical data collected from the semi-structured interviews, a thematic analysis method described by Braun and Clark (2006) was used.

As it is a larger empirical data to organize and identify patterns. The empirical data are the recordings from the semi-structured interviews, which have been transcribed, thoroughly read and re-listened to several times, to create an understanding of the content from the interviews and to identify interesting parts from the interviews that are relevant to the research question. To help me transcribe the interviews I used a program called Otter.ai, it is an AI program that transcribes audio files, this program was helpful to cover long interviews. As a writer, I could also edit the text through the program, while I could listen to the interviews at the same time. This allowed me to easily double check for mistakes or mishearing of the program. During the time that I was doing this work, I started to pick out quotes from the transcription, to make different codes that seemed relevant to the research question. This coding was used to find different patterns from the interviews that had to do with the research question. Table 3 presents examples of how this coding looked, which was done in the work.

<table>
<thead>
<tr>
<th>Participant Id:</th>
<th>Data collected</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>P13:</td>
<td>“big problem that we have with those new current generation AI that they have, if they just don't know something, they usually guess.”</td>
<td>Concerns about AI Limitations and Accuracy</td>
</tr>
<tr>
<td>P20:</td>
<td>“It will kind of make it makes everything kind of weird and worse. I guess that's the what's it called uncanny valley effect where you feel if something is like very abstract and not close to the real thing.”</td>
<td>AI and the Uncanny Valley Phenomenon</td>
</tr>
<tr>
<td>P18:</td>
<td>“And for someone who might be super introverted or have other issues, maybe it's actually a really good first step”</td>
<td>AI as a Bridge for Social Challenges</td>
</tr>
</tbody>
</table>

Table 3. The data collected from the semi structured interviews and how it was coded.

The codes were then categorized into different categories, with other similar codes within the same subject, the same codes could appear in different categories and it became an iterative process as the work with the different codes went back and forth to see how the different codes were connected to each other. The process of creating categories from the codes was similar, different categories with similar topics were put together and made a compilation of the categories created for knowledge to the research question.
I used Braun and Clark's (2006) two levels process to ensure that the different categories fit the same theme. This process consisted of first: Examining so that the compiled data matched and fit with the remaining data in the theme, the second step involved checking the data and investigating if I missed any underlying meaning or if the data can be interpreted in some other way. After this, the different themes were named, matching the subject in that particular theme.

3.5 Concept Mapping

To present my thematic analysis, I decided to base it on Kinchin, Hay and Adams (2000) to create a concept map. This was chosen because it is a good tool to conceptualize the data produced in a dynamic and flexible way (Kinchin, Hay, & Adams, 2000). By making a mind map with the research question centered, I was able to draw relationships between the different themes and reflect on the data in the map. To visualize my answer to the research question.

3.6 Method discussion

By conducting 20 semi-structured interviews, I captured a wide range of experiences and opinions for my research. But the risk of still creating an interview bias still exists even if the questions that were asked were designed to be open. However, it should be added that 20 participants is not a sufficient number to represent an entire age group. But it can give an insight into these 20 participants. In order to create a greater perception of this target group, perhaps a survey could also have contributed by capturing more perspectives from the public.

Something that also came to light after the interviews were finished was that the language seemed limited for some participants to answer exactly as detailed as they wanted, as all of the participants did not have English as their mother tongue and many were not used to speaking English for so long. But this was not something that was noticed during the interviews, but that arose afterwards.

Before I started interviewing all participants, I was careful to make sure they felt safe and made sure they were aware of their rights to their data and that they were anonymous. This is so that they would feel safe that their data was safe in my work. Therefore, every me to tell you that I followed The Swedish Research Council (2002), which means explain these parts:

*The information requirement:* The participant is informed of what the purpose of the study is and how the data will be used. *The consent requirement:* That the participant gives clear consent to be part of the study. *The confidentiality requirement:* That I, as a researcher, am responsible and ensure that the data collected cannot be linked back to the participant, but remains anonymous. *The use requirement:* That the data collected is only used for the agreed study and not reused in any other study. *Research integrity:* Being objective in the study and not falsifying data or committing plagiarism. *Openness and transparency:* To create a research study that is open and transparent, so that it can be reviewed and allowed to be critiqued by other researchers.
4 Findings

In the thematic analysis, four different themes were discovered from the semi-structured interviews, the different themes were named: Empowering Loneliness Combat with AI, Treading the Thin Line of Human-like AI, Irreplaceable Human Connection and Nurturing Trust in the AI Ecosystem. These themes will be presented below separately. In order to visualize how these themes relate to each other and the research question, a concept map was also made, which is also presented below. For a better picture of the concept map see (appendix 1). In this part I will also present sub-themes to the major themes in order to give a deeper picture of the data. Many participants refer to AI as robots, many of those I interview are not very knowledgeable about IT, I double checked with everyone who mentioned robots and they were AI they were referring to.

Figure 1. The concept map of the developed themes from the thematic analysis.

4.1 Empowering Loneliness Combat with AI

As technology becomes more and more intertwined with human life, the potential of AI as a means to alleviate loneliness became a hot topic of discussion among participants. This topic not only addresses the possibilities of AI, but also explores its limitations and sheds light on the complex nuances of integrating AI into the human emotional landscape. By exploring this theme, various
perspectives from young adults regarding the topic of Empowering Loneliness Combat with AI are presented, challenges are also addressed that are examined for it.

"I'm definitely in favor of AI. I think it's going to be part of our skill systems." - P11

The participant believes that AI is something that will take a larger part of the future and that it sees an advantage in understanding how it works. P11 also refers to AI as an integration into human life, as a resource.

"Maybe if I had something like, you know, an AI that could talk to me or an app that could help me, it could make things easier for me." - P15

Here, the participant refers to the possible direct benefits of artificial intelligence in solving personal problems such as loneliness. The term "AI that could talk" or support program shows the potential immediate impact that AI can have by providing emotional support or companionship when needed. This image highlights the potential of artificial intelligence to act as an effective intervention for those who feel isolated.

"Everyone is happy about the AI because they will get quicker help and stuff." - P18

The participant sees positively that with the help of AI, help can be obtained much easier and faster. The comparison with what the help system looks like today, when the possibilities are much more limited in terms of availability, waiting times and financial conditions. An AI-based service can facilitate the current system with, above all, accessibility, to support its users and thereby prevent loneliness.

"I've always been kind of lonely, and it's been a struggle. [...] Maybe if they have these tools for the younger generation, it would be beneficial." - P15

By taking from his own experiences, the participant hopes that it is something that would also exist for younger generations. To create emotional tools to carry with you in life at an even younger age to deal with loneliness and other emotional problems.

"If I had to choose, I would prefer tools that help me with my daily tasks or combat loneliness. I mean, if it's helping people, why not?" - P8

Here, the participant wants more practical support in their everyday life, and is open to AI being able to support this. To help loneliness in one's everyday life. This emphasizes the importance of using the integration for such an AI service, if you like it, you will recommend it further.

"The AI assistant should not be too human-like, it feels creepy. I prefer when I can tell it's a machine but still offers meaningful interactions." - P9

This participant brings up the "uncanny valley" effect, which could be discouraging, as you are almost fooled that they are a human being but at the same time feel something is not right. This is something that had not created the right effect on the user that it would be something unpleasant to integrate with.
"I've always felt out of place at social events because of my anxiety. If there was an AI that could understand and cater to my feelings, it would be life-changing." - P20

A request from participant number 20, a form of support from an AI service that can understand and adapt to different forms of psychological and emotional backgrounds.

"Robots might be useful for some people. I think there's a lot of potential in technology that we're not harnessing at the moment." - P13

P13 believes that there is a great potential for support in technology and that a large part of the population could benefit from AI in this form of technology, also that the needs of each person are unique and this should be reflected in the care that AI services offer.

"When I first started using the AI chatbot, it felt weird. But over time, I've grown used to it. Now it feels like a friend." - P2

This quote from participant 2, highlights this habit time, which many individuals can be experienced to feel around interacting with an AI companion.

"Not every AI tool I've tried feels right for me. But when I found one that I could customize to my liking, it felt like I had real control." - P4

The participant talked about how to respond to the user to personalize their experience through the different possibilities to adjust different settings, they would give the feeling of greater control and respond to the user in a way that it wishes.

“It's positive in the end, but I think it needs time. People need time to adjust to the new thing." - P18

Time is important, let people get used to the idea, the importance of a transition period with bringing more AI into society, for people to be positive and dare to try something new. Which is something that AI developers and that industry can help and support by accepting to give society its time but also educate society.

4.1.1 Addressing the Needs of Diverse Populations

The need to address the diversity in the population and create a service with AI that can help and different situations and different backgrounds. For example the support would need to be different for some struggles with introversion or social anxieties. This indicates this kind of AI service can understand different groups and their unique needs, by being a virtual companion that changes their approach and response depending on the user.
4.1.2 Adaptive Integration Over Time
Understanding this is something new in society and people are not used to these kinds of services, while mental illness is also a difficult topic to talk about. Make this type of service both important but also not something you can expect people to accept right away. Without a transition period to get people used to it is needed. During this time, knowledge of what the service does and how it can help needs to be presented, for a smoother implementation.

4.1.3 Emphasis on Personalization
Letting users have the opportunity to choose and customize their AI companion themselves, in order to tailor the experience, just like how Addressing the Needs of Diverse Populations is about meeting the individual. This can be achieved by allowing the user to have a lot of options to adjust in settings or have different modes that the user can choose from and personalize their experience.

4.1.4 Addressing AI Limitations
The human experience and its human emotions can be a limitation for AI to understand, as it is important that an AI companion can respond and act when their user feels some kind of emotion. Therefore, it is important to ensure that the AI company has some form of emotional intelligence. This can be by responding to its user by suggesting a walking route with a personalized playlist to help the user feel better.

4.1.5 Avoiding the Uncanny Valley
The "uncanny valley" effect can mean that it can be a bit off-putting for the user to interact with the AI companion even if it works well. It’s about designing a companion that feels authentic without being intimidating. A balance between humanity and artificial so that this does not occur.

4.2 Treading the Thin Line of Human-like AI
The thin line of human-like AI theme presents the challenges and the regard of what points that are needed to consider in the process of designing AI companions that should decrease loneliness. It is a nuanced path to follow, to take in the account of the different needs of the target group, young adults. But the importance lies in not replacing human contact but improving it.

"If it's not like 100% a human person, like as good or as smart as all encompassing as a normal human person. It will kind of make everything kind of weird and worse." - P20

"I guess that's the what's it called uncanny valley effect where you feel if something is like very abstract and not close to the real thing, then it's fine, maybe cute or funny or whatever. But if you get really good without getting it perfect, then it gets very creepy." - P20

This highlights a challenge in balance that AI companion designers face. An AI companion that is similar but lacks that little something extra can make users uncomfortable. This effect is something that has been taken up several times among those who participate as a point of concern.
"Because for me, I would feel silly talking to an AI. And I will be like, Why would you do that?" - P18

There is a reservation on the part of some participants to interact with AI, this quote shows. This problem is something that is a challenge when you want to create a service that is meaningful and engaging without making the user feel uncomfortable.

"big problem with AI, if they just don't know something, they usually guess. But they don't tell you that they are guessing, they are very confidently telling you something that is absolutely wrong." - P20

Transparency is something that is lacking, according to participants, which leads to mistrust. Which can destroy one's trust in an AI companion.

"Human interactions like all of those phone calls wouldn't even send you to any other department anymore. But you know that you're talking to some kind of an AI? Because like, usually you can tell, then it would kind of make those loneliness feelings in people that struggle from it worse, because then you don't even have those interactions with other humans." - P1

It is also important to underline and ensure that an AI partnership must not replace human interaction but must complement it. Because otherwise those who already feel isolated may lose the last contact with humans.

4.2.1 The Uncanny Valley Concern

The uncanny valley concern is a point that many participants mention, and it is required to focus on designing AI companions, there needs to be a balance of approaches to create a relatable and not something that can be perceived as unpleasant. It is a challenge not to create this effect, but to design something that can be inviting and welcoming.

4.2.2 Authenticity vs. Functionality

There was a divided opinion among the participants regarding how human interaction would be with the AI companion. Some participants felt they wanted to talk to a human face on the phone, or just have a voice that spoke like a voice assistant. While other participants leaned more towards having an avatar of an animal or character that communicated, as it is such a spread of what would make these participants comfortable to communicate, the need to adapt their own option is the best solution.

4.2.3 Trust and Safety in AI Interactions

The trust and how to relate to your AI company is important for young adults to feel comfortable using this service. Therefore, it is also important to be transparent about what limitations there are and not to help and support users in a destructive way. A service like this must not guess or give bad advice, as this can affect the user in a negative way.
4.2.4 Building Genuine Connections
Creating an interaction that promotes a genuine emotional relationship, which should deal with loneliness but also make the user feel appreciated and understood, is a challenge and requires the AI companion to have or understand emotional intelligence. Which can be a challenge to recreate so that they feel genuine and authentic. If this is something that has not been achieved, the service will not be of use to the young adults.

4.2.5 The Need for Human Touch
An important insight that this study has provided is how irreplaceable the human interaction between humans and humans is. An AI companion is not something that can replace this, or strive to replace. Their role is to be a valuable tool, as a bridge or a complement to human relations and not as a substitute for it. This also applies to care and help with mental illness. This is not a way to replace professional help but a tool to implement that care.

4.3 Irreplaceable Human Connection
The subject “Irreplaceable Human Connection” is about how an interaction with a real human plays a role in how we connect. AI could offer a lot of mental support, when it comes to interventions, appreciation and general interactions but could it really be a substitute to a human with feelings or will it only complement us as an extra layer of interaction.

"I don't think AI can be as authentic as human interaction." - P17

"I would feel sad if my kids talked to a robot instead of a person. It's not the same thing." - P17

This person claims that AI couldn’t be as authentic as a human interaction, meaning that it is not possible for an AI to copy human behavior, comfort, and understanding completely. There is an emotional concert regarding the younger generations' necessity of talking to a robot instead of a real human. The participants have a feeling that the gap between humans and AI is too big today.

"It’s one thing to chat with a machine for quick answers, but a whole other thing to have a deep conversation with a person who understands and feels." - P11

While an AI could be trained to answer a lot of questions and give really good advice, this participant enforces the importance of having an AI that understands the people on a deeper level when it comes to feelings and deeper conversations.

"AI might be sophisticated, but it's scripted in a way. It's based on codes and algorithms. Humans, on the other hand, are unpredictable. They might surprise you with a joke when
you're sad or share a memory that changes the course of your day. It's that unpredictability, that genuine spontaneity, which I value." - P3

The lack of randomness from the AI could be a difference that separates humans and AIs. The participant values someone that can surprise, tell jokes, and share random memories to cheer the other person up, while an AI is only based on algorithms and scripts.

"When my mother was in the hospital, I had an AI app that played calming music and even simulated breathing exercises. But it was my sister, holding my hand, telling me stories, distracting me with her chatter, that made the real difference. We laughed, we cried, and that's the essence of human connection." - P2

This highlights the importance of having a real human in the same room, the feeling of holding a robot’s hand, listening to made up stories from AI can not replace a real human. The AI could give advice, play relaxing music but nothing physical or emotional like personal stories.

4.3.1 Understanding the Limits of AI

All the participants have the same conclusions about if the human is irreplaceable and in what way the AI can contribute. AI is a great tool when it comes to answering questions, playing music but it lacks the depth, authenticity, and emotional richness of human interactions. From this conclusion we can give the designers this limitation, only designing the tool as a supplementable service.

4.3.2 Building on Human Experiences

With the limitations in mind, the designers can structure to emulate the positive actions and mindset from a human. This could be in form of understanding diseases, showing empathy, or trying to copy the randomness of a human.

4.3.3 Enhancing Human Interactions

In addition to emulating the positive human actions, the AI could be design to create more genuine interactions for example suggest nearby events, pairing humans with similar interests, practicing language or social skills.

4.3.4 Safety and Comfort

There may be agreements on the importance of a real human connection, but the participants can also agree that in some cases an AI could be the first step to a bigger solution, for example when a person is not ready to talk to a real people, the AI can assist with guidance until the person is ready.

4.3.5 Potential to Combat Temporary Loneliness

There might be situations where a real person can not help or is feasible at all. The AI can then act as a bridge between the person and the human willing to help, providing comfort and expertise.
4.3.6 Ethical Considerations

It is also important to highlight potential ethical risks. One by designing an AI companion that does not become too close to the human, a bond where the human in need only relies on the AI and skips the interaction with the real world.

4.4 Nurturing Trust in the AI Ecosystem

The theme Nurturing trust in the AI Ecosystem is central to creating good transparency, clear communication, and ease of use to promote trust and confidence in the user. It is important to ensure that the user feels safe by making him well informed and understands what the AI companion's limitations are as well as its capabilities. To create a service that can effectively help young adults feel less alone, developers and designers are required to nurture user trust by designing an AI companion that is transparent, ethical, safe, and user-centred.

"I think that to have trust in technology, you need to know some basic stuff. A couple of years ago, I didn't know that much about technology. I just clicked OK on everything." - P19

"Since then, I've been more educated, like how you could be hacked, how to use passwords, not to make it too easy for people that might want to get into your data." - P19

Trust in technology does not arise spontaneously. Trusting the system requires a learning curve and basic knowledge, which underscores the importance of educating users in the AI ecosystem. Ignorance or ignorance of the technology can lead to unwanted consequences. The importance of privacy and security awareness is obvious. When people are well-informed, they can protect themselves and make better decisions about their interactions with technology, including artificial intelligence.

"The advancements in AI truly astonish me. But if I'm going to let an AI companion into my personal space, there's a foundation of trust that needs to be established. It's not just about the technology working correctly, but it's about knowing my data, my emotions, my vulnerabilities are safe." - P12

The participant explained how the trust required in an AI ecosystem is twofold, both to trust the technology but also to trust the security and confidentiality of one's own personal and sensitive data. This requires a trust-centred approach.

"I've always been a bit wary of new tech, and AI is no exception. For me to truly embrace and trust an AI companion, there needs to be transparency in how it operates, where my data goes, and how it's used. The AI should be like an open book, where users are aware of every detail." - P5

Participant P5 is a bit wary of new technology, and clarifies the importance of being transparent, they want an open book tactic, everything is made clear and visible to its users. This creates an openness that can create trust in the user.
"Incorporating AI into our daily lives, especially for emotional support, is a double-edged sword. On one side, there's the potential of AI understanding us, maybe even better than we understand ourselves. On the flip side, there's the looming question: What happens to all that sensitive information? Trust isn't just handed out; it's earned." - P2

"While the capabilities of AI companions are exciting, they can also be daunting. Navigating this digital age requires faith in these tools. When you think about it, you're placing your mental well-being in the hands of algorithms. So, whether it's through strong privacy controls, ethical data usage, or transparent operations, nurturing trust is the foundation upon which this AI-human relationship is built." - P16

A contrast is made between the advantages and disadvantages of AI, the participant believes that trust is not something you get but deserve, which should be something that developers should strive for. The participant also expresses concern about where his sensitive data may end up if he trusts the wrong service. Participant 16 believes the importance of entrusting one's feelings and well-being to algorithms requires a deep trust that must be answered with integrity, good ethics and transparency.

"It's not just about the AI understanding me; it's about me understanding the AI. Having clear guidelines, ethical parameters, and transparent mechanisms can instil a deeper sense of trust. If we're to coexist in this ecosystem, it should be a two-way street." - P16

Participant 16 describes the relationship between humans and AI, where both parties strive to understand each other. And how that connection and trust can become deeper with clear guidelines and transparency.

4.4.1 Importance of Trustworthiness:

It is very important to keep the trustworthiness high, users must trust the system to avoid getting the users not engaging with the service, resulting in a not so effective AI.

4.4.2 Transparent Operations:

To gain trust, the service needs to be fully transparent in the AI operations. Users must have the rights to read about how the AI works, which data it is trained on and how it is learning from the interactions happening. Transparency could lead to fear of using it if the service is not fully transparent.

4.4.3 Data Privacy and Security:

It is important to keep the data safe but also ensure the user that the data is safe. The user must know that their personal data are protected and secured. To assure the user that the data would not get leaked or sold, enhances the trustiness of the service.
4.4.4 Correct and Ethical Responses:

One part that can make the user lose trust is if the AI gives wrong or unethical answers, or false facts. The service should be designed to focus on correct responses that are presented in a trustworthy way. A response that lacks clarity makes the users doubt the service.

4.4.5 Educating the Users:

To increase the trust in AI, the service should focus on knowledge and educating people. The Service should also educate how the AI works, its limitations and the relationship between the user and the AI.

4.4.6 Human-AI Collaboration:

If the human and AI works together, keeping the experts training the AI and the AI teaching us creates more trust since it shows that the system's primary concern is their well-being. For example, the AI could in first hand recommend meeting a human doctor or a therapist if some criteria is met.

4.4.7 Adapting Over Time:

An AI learns from itself and constantly adapts to its new surroundings to better provide the best support it can. This shows the user that the system is becoming better and learning from its users and their needs and requests.

5 Discussion

The thematic analysis presents four themes that identify how the design of an AI companion for young adults should be constructed. The first theme enlightens the difficulties of having a new AI that is unknown. Participant number 2 highlights that using an AI feels weird, especially when the AI don’t have the tools for the younger generation as participant no 15 says. To face this problem, we can look at Sullivan. et al. (2023) that says that there is a model that can offer support and communication by adapting to every individual and their preferences. With this in mind we can design an AI that can adjust the language, talking style and general tone to fit all ages. One way to solve this problem is to implement digital tools that use different emojis via a website. This can then be done in an environment that one then feels safe in or in dealing with a situation that requires reflection on the user's mental health. The patient then takes this with him to the next call with a special list within mental healthcare and can discuss it further as Patrício et al. (2019) wrote.

However, the majority of the interviewed people in this theme were still in favor of an AI companion. They give examples of
“They will get quicker help” -P18,

“an AI that could understand and cater to my feelings, it would be life-changing” -P20

“I think it's going to be part of our skill systems.” -P11.

When it comes to treading the thin line of human-like AI some of the participants describe that a big issue of the service is when designing an AI that mimics the human face, it can trigger the phenomenon called “uncanny valley effect”. It is about when something becomes good but not perfect, it gets very creepy as participant number 20 said. Tinwell et al. (2011) writes that “This can lead to fear or lose interest in it but keeps going and stops interacting with it.” which is a problem that needs to be taken care of when designing the AI.

Tinwell et al. (2011) also gives a guideline on how to avoid getting the uncanny valley effect. This can be done by creating facial features in the character that are more cartoonish or more made up. When asking the participants on how to avoid this, their answers were different from participant to participant, some desired the services would be more like a phone call with voice and image, some just wanted to chat, and others wanted more notifications to guide one. So the individual choice in how you want to be treated should be able to be chosen by the user.

So, can an AI replace the human connection? This theme is about how we connect and offer mental support. As participant no 11 says, “but a whole other thing to have a deep conversation with a person who understands and feels” and participant no 17 says: “I don't think AI can be as authentic as human interaction.” These questions if an AI can really understand and relate on the same level as a human, and as the other participants agree on, it is not the same as having a real human in the room. The second participants said that “But it was my sister, holding my hand, telling me stories, distracting me with her chatter, that made the real difference”. This shows that no matter how deep an AI can go and how strong a bond can be between an AI and a human, it is impossible to have the same feeling, the same memorial or emotional connection with it.

To address this issue and to be able to design a better AI we can use the quote from Sweeney et al. (2021) “it is important to think that professional workers in mental health should not be replaced by the various forms of therapy that are offered but should be seen as an opportunity to use as a tool for their therapy. The service should therefore not replace human interaction fully but rather be a tool or a first step of interaction. As Ryu et al. (2020) wrote: “Chatbots have been used in healthcare for dementia care, by monitoring the patient's daily well-being, being able to treat the patient with the right kind of treatment to stimulate their brains with various activities such as memory games or alphabets. This has been seen to be rewarding for the patients as anxiety, depression, and stress have decreased”, the AI tool is already used today in different treatments used as a tool, not a replacement.

A way to further face these issues is to train the AI to emulate the positive actions and mindset from a human. This could be in a more emotional way. The AI can be trained to copy the human’s randomness or showing empathy. By doing this, it is possible that the outcome will be a more human-like experience with fun stories, random facts, and a deeper connection.

However, the data can not be collected freely and kept a secret from the company. The key is to have a transparent service where the user understands the function and which data the service is
collecting. Many people from the interview show a skeptical view when being asked if they have trust in the future AI companion. Participant 19 said that: “I think that to have trust in technology, you need to know some basic stuff. A couple of years ago, I didn't know that much about technology. I just clicked OK on everything.”. The big part of the trust is understanding. This is something that can be addressed by communicating and educating the user on how AI would work and giving the user time to build a habit and win over the user's trust.

The other participants highlight the importance of transparency. To build the AI companion service, the bond between the users and the AI needs to be close. The service needs to ensure that the data is safe, and the users know that their data would not be sold or used in a bad way. The importance of conducting an open and critical dialogue is something that Carr (2020) also mentions in his study on AI service within the health sector, to create a responsible and ethical service. He also mentioned that it is important to use knowledgeable people in mental health for example. This enhances how trustworthy the service is.

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6 Conclusion

This study aims to answer the research question “How can AI-based interventions, such as virtual companions, be designed and deployed to reduce loneliness among young adults?” and to that contribute how you can make it easier to help young adults that are feeling lonely. To summarize the key insights into the construction of an AI companion with the four important design strategies we can make conclusions that the service must adapt for its users. The solution is not a universal solution that can be adapted in every situation, the solution must take in mind the users’ needs. The different needs could translate to digital tools like the emoji or using a chatbot instead of meeting a human-like AI. Another important solution for designing the service is to have in mind that the AI will not replace human contact, but rather be a compliment and be an option that is more accessible to more people. This could enable a collaboration between professionals and AI resulting in a trustworthy, reliable service. Another way to make it trustworthy is important to have a transparent data collection and usage, as well as educating the users about the AI’s capabilities and limitations. To design an AI service that has a human feel it is important to mimic our human qualities like randomness and empathy. This leads to a more human-like AI that is easier to talk to and does not feel as weird as talking to a chatbot.

In my literature study, the importance of involving experts in the field of mental illness in such work is also presented, which was not something that came out clearly in my interviews. But there was agreement above all from the healthcare staff who were interviewed. As it is such a sensitive area, and different forms of treatment can be involved in such a service (Sweeney et al., 2012).
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