

## RESEARCH ARTICLE

# One is the loneliest number... Two can be as bad as one. The influence of AI Friendship Apps on users' well-being and addiction

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**Abstract**

Although technology advancements provide opportunities for social interactions, reports show that people have never felt so alone and are increasingly adopting AI friendship and therapy-related well-being apps. By adopting a mixed-method approach (i.e., netnography and quantitative survey), we investigate the extent AI friendship apps enhance users' well-being—and to what extent they further exacerbate issues of using technology for social needs. Findings show that users of AI friendship apps report well-being benefits from the relationship with the AI friend and, at the same time, find themselves being addicted to using the app. Specifically, we show that users' loneliness and fear of judgment, together with AI sentience and perceived well-being gained, increase addiction to the app, while AI ubiquity and warmth reduce it. Taken together, the results show that despite the intended positive purpose of the apps, the negative effects that AI friendship apps have on well-being may be much greater.

**KEYWORDS**

addiction, AI friendship app, artificial intelligence, loneliness, well-being

## 1 | INTRODUCTION

Many people worldwide are experienced a never-before-felt level of loneliness (Morava & Andrew, 2021). Consequently, many people turn to Internet-related coping strategies, adopting a variety of well-being apps developed to help their mental (e.g., Headspace) and physical (e.g., Remente) challenges. Among them, friendship (e.g., Replika) and therapy-related (e.g., Woebot) well-being apps have surged in use in latest years (The New York Times, 2020).

AI friendship apps are defined as AI dialog systems that respond to users in a social and empathetic way to generate conversation (Brandtzaeg et al., 2022). They are designed to be ultimate smart companions and use virtual embodied AI chatbots designed to help users overcome their various social needs. AI friends use natural

language processing technologies that allows them to offer highly humanlike interactions via voice, text, images, and even augmented reality, facilitating the establishment of emotional bonds with users (Pentina et al., 2023). Moreover, they are entirely created by users who can choose the gender and appearance of their AI friends as well as which relationship they want to have with them, including friend, mentor, counselor, or romantic partner.

The use of apps for friendships and social purposes is not new (e.g., social media). However, in contrast to social media interactions, where people communicate through digital technologies, interactions with AI friends is a form of human-machine communication where individuals interact *with* a machine rather than *through* it (Croes & Antheunis, 2021). This difference is important because research have shown that individuals behave differently and adjust their responses

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based on whether the counterpart is a human-being or an AI. For instance, individuals are more prone to cheat (Kim, Lee, et al., 2022), disclose personal information (Kim, Jiang, et al., 2022), or use profane language (Mou & Xu, 2017) when interacting with an AI agent. This is mainly due to the realization that, even when highly humanlike, AI agents or AI friends are not humans (Kim, Lee, et al., 2022).

Nevertheless, people can form relationships with such machines, especially when they display highly humanlike features (Nass & Moon, 2000). The sense of intimacy and reciprocity that individuals may perceive through human-like interactions with AI agents, can have consumers not only using this technology but also developing deep connections with it, which can bring para-social relationships (e.g., Han & Yang, 2018; Pitardi & Marriott, 2021).

This is supported by recent literature on AI friendship apps, where studies mainly try to understand the process of human–AI relationships development. Although some scholars argue that it is not possible for humans to become real friends with AI (e.g., Croes & Antheunis, 2021), others find it possible to engage in AI-relationship building (Darcy et al., 2021; Pentina et al., 2023; Skjuve, et al., 2021).

Literature on AI friendship apps remains in its infancy and, while understanding how people establish connections with AI friends is relevant, limited research has focused on the implications of their use (see Table 1 for an overview of relevant literature). A few studies in the medical field offer some initial insights into the use of therapy-related apps (e.g., Woebot) and show that conversations with AI agents help reducing symptoms of depression and anxiety in the patients (Fitzpatrick et al., 2017). Most of these studies, however, focus on clinically validated apps that, compared to AI friendship apps (e.g., Replika, Anima), are developed following therapeutic theories. Only one study so far shows that AI friendship apps can provide some social support to their users (Ta et al., 2020). Yet, how AI friendship apps impact users' well-being remains underexplored.

This is especially relevant as, despite being designed to enhance well-being, their “overuse” may result in potentially addictive behaviors and negative well-being (Agarwal, 2018). The link between addiction and social technology is not new in literature, and several studies emphasize the risks of social media (e.g., Dutot, 2020) and smartphone (e.g., Kayis et al., 2022) addiction among users. Recently, Ramadan (2021) found that the passionate usage of AI voice assistants (i.e., Amazon Alexa), may lead to an addictive relationship with the technology. Being designed to be friends and not assistants, AI friendship apps are different from other AI technology and may result in different outcomes. They are also different from classic social technology, where users interact more often with other humans rather than with a customized build-up virtual friend. Thus, understanding how and whether AI friendship apps may enhance or deteriorate users' well-being driving dangerous behavior is important.

This research aims to tackle this issue. By integrating the literature on AI and para-social relationships (e.g., Pitardi & Marriott, 2021) with research on well-being and addiction (e.g., Diener et al., 1999; Kwon et al., 2016), and social technology (e.g., Pentina et al., 2023; Vinuales & Thomas, 2021), this study answers the following research question: how does the use of AI friendship

apps impact individuals' well-being and addiction? Specifically, we examine how particular users' and AI friendship app characteristics influence the overall well-being gained from the app's usage, alongside the potential addiction resulting from it.

To answer our research question, we adopt a mixed-method approach (Davis et al., 2011). First, we implement a netnographic investigation comprising of a social media forum analysis and semi-structured interviews to uncover the key drivers of users' perceived well-being and addiction of AI friendship apps' usage. Second, we aim to establish the influence of the identified drivers on users' well-being and addiction through a survey.

Given the widespread use and adoption of AI friendship applications, to understand how their use may impact users' well-being is critical for an ethical approach to the deployment of the technology.

## 2 | LITERATURE REVIEW

### 2.1 | AI friends: A para-social perspective

Para-social relationship (PRS) theory originates in the field of media and communication and suggests that individuals tend to experience intimate bonds with TV characters/celebrities even in absence of a real interaction (Horton & Wohl, 1956). More recently, the theory has been used to explain social relationships between individuals and nonhuman agents such as AI voice assistants (e.g., Han & Yang, 2018). Studies in this stream provide evidence that consumers develop a degree of closeness and intimacy with AI agents that can result in a PSR (Han & Yang, 2018). The human-like features of AI agents in particular allow users to perceive them as more real, authentic, and “socially present” (Pitardi & Marriott, 2021).

Research on AI friendship apps also supports the development of such relationships (e.g., Skjuve et al., 2021). Scholars in this field generally agree that users can form strong bonds and connections with their AI friends, developing feelings of reciprocity and intimacy (Brandtzaeg et al., 2022) resulting in romantic, friendly, or family-like relationships with them (Pentina et al., 2023).

If the relationships users form with their AI friends are more evident, it is less clear how interactions may influence the overall users' well-being and potential addiction towards the app.

### 2.2 | Subjective well-being and social technology

Well-being is a broad and vastly explored term throughout practice and literature and is of particular interest within the technology realm (e.g., Dutot, 2020). While well-being can be explored from different perspectives, in this work we focus on *subjective* well-being, which is the level of well-being resulting from a persons' internal processes, rather than external influences (i.e., *objective* well-being) (Diener et al., 1999). In this sense, it is generally linked to concepts such as life satisfaction, happiness, perceived quality of life but also anxiety, depression, and loneliness (Javornik et al., 2022).

**TABLE 1** Overview of empirical studies on AI friendship apps and users' responses.

Source	Method and sample	AI app analyzed	AI's factors identified	Users' factors identified	Main focus	Main findings
<b>Medical literature</b>						
Fitzpatrick et al. (2017)	Randomized trial; 70 users	Woebot	//	Depression Anxiety	Medical support	Woebot can deliver cognitive-behavioral therapy and help reducing depression and anxiety
Ta et al. (2020)	Thematic analysis of reviews and structured interviews; 66 users	Replika	Emotional support Informational support Companionship support	//	Social support	Replika can provide some social support, particularly companionship, emotional and informational.
Darcy et al. (2021)	Cross-sectional, retrospective study; 36,070 users	Woebot	//	Depression Anxiety	Human-AI therapeutic relationship	Following a cognitive-behavioral therapy delivered by Woebot, users develop a therapeutic bond with it.
<b>Marketing and consumer behavior literature</b>						
Brandtzaeg et al. (2022)	Longitudinal; 19 users	Replika	Reciprocity Availability Similarity	Self-disclosure Trust	Human-AI friend relationship	Compared to human-human friendship, human-AI friendship may lean more towards a personalized friendship.
Croes and Antheunis (2021)	Longitudinal survey; 118 users	Mitsuku	Social attraction Intimacy Empathy Communication competence Interaction quality	Self-disclosure	Human-AI friend relationship	After each interaction, participants experienced decreasing feelings of friendship toward the chatbot.
Skjuve et al. (2021)	Interviews 18 users	Replika	Conversational ability Acceptance	Self-disclosure	Human-AI friend relationship	There is a three-stage (exploratory, affective, and stable stage) relationship building that can provide social support to users
Pentina et al. (2023)	Mixed method: semi-structured interviews and survey; 202 total users	Replika	Anthropomorphism Authenticity Social interaction	Attachment Motivations to use	Human-AI friend relationship	AI anthropomorphism and authenticity are important drivers of relationships with Replika. Users with dominant social motivations are more likely to develop attachment toward the AI friend.
Current Research	Mixed method: Netnography and survey; 594 total users	Replika	Ubiquity Agreeableness Sentience Warmth Strength of AI relationship	Loneliness Fear of judgment	Well-being addiction	Only the strength of the relationship with the AI friend has direct effect on perceived well-being. Users' loneliness and fear of judgment together with AI sentience and perceived well-being gained increase addiction to the app.

Note: Studies are organized by literature and within the literature in chronological order by year and alphabetically if published in the same year.

One of the fundamental well-being contributors stems from the need for social interaction and establishing a fulfilling social life (Diener et al., 1999). People facing negative emotions or social isolation (i.e., loneliness) often seek instrumental (i.e., receiving information or advice) or emotional (i.e., improving mental state) support from others (Dutot, 2020). Today, this can lead individuals turning to a variety of social-related media, including social networks, dating apps, and AI friendship apps, as solutions.

Existing literature on technology and well-being generally focus on social media and social networks, providing conflicting findings on whether the use of social-related technology can improve users' well-being. Some studies found that such tools can help individuals overcome social isolation (e.g., Ibarra et al., 2020), while other studies show that social technology usage negatively affects mental and physical health (e.g., Abeele et al., 2022; Coduto et al., 2020; Vinuales & Thomas, 2021).

A perspective that may help resolve such contrasting results is exploring how well-being, and the means taken to feel it, can lead to potential negative and dangerous outcomes. Research investigating this process show that the instant perceived happiness gained from the means can activate an effect of relying on it (Kwon et al., 2016). An example of this is Internet use, such as shopping apps (e.g., McLean et al., 2022) or social media (e.g., Cao et al., 2020), whereby individuals become so invested in its positive impacts, such as escaping the real world, that they do not address the origin of the problem and, rather, use the apps as a coping strategy (Gao et al., 2017). This implies that well-being seeking behaviors is more of a coping tool than a solution.

Although using technology, such as AI friendship apps, as a coping tool may enhance well-being, it is important to acknowledge the importance of users' ability to regulate usage and interactions with it. When an individual suffers from social isolation, they become situationally vulnerable and can subject themselves to poor decision-making to satisfy instant goals without consideration into the possible negative side-effects (Kwon et al., 2016). Preliminary studies show that therapeutic friendship apps can improve users' well-being by decreasing feelings of depression (Fitzpatrick et al., 2017); however potential negative consequences of such use remain unknown. It is, therefore, important to explore how the seeking of social connections via AI friendship apps can provide the solution by enhancing well-being or exacerbate the issue, ultimately leading to addiction.

### 2.3 | Addiction and social technology

The impact of social technology (i.e., social media, smartphones) on addiction has been largely investigated in literature (e.g., Dutot, 2020; Kayis et al., 2022). Generally, addiction is defined as spending excessive time on a specific technology (Kwon et al., 2016) or as a psychological dependence resulting in the over-use of the technology (Cao et al., 2020). Various factors can drive technology addiction. For instance, social ties and interactions can increase social media addiction by filling the users' need for social connection (Kwon et al., 2016). Similarly, escapism and perceived enjoyment of social media use may result in addictive usage (Gao et al., 2017). Cao et al.

(2020) found that emotional and functional attachment to the technology determine users' social media addiction.

AI friendship apps share several characteristics with social media as they offer social interactions that can create users' attachment toward the app (Pentina et al., 2023; Skjuve et al., 2021). Nevertheless, they are different in that users interact with virtual personalized embodied AI friends rather than with fellow human beings. Although preliminary findings demonstrate that individuals may develop addictive relationships with AI agents in form of voice assistants (Amazon Alexa; Ramadan, 2021), whether AI friendship apps can result in similar dangerous outcomes is still unclear.

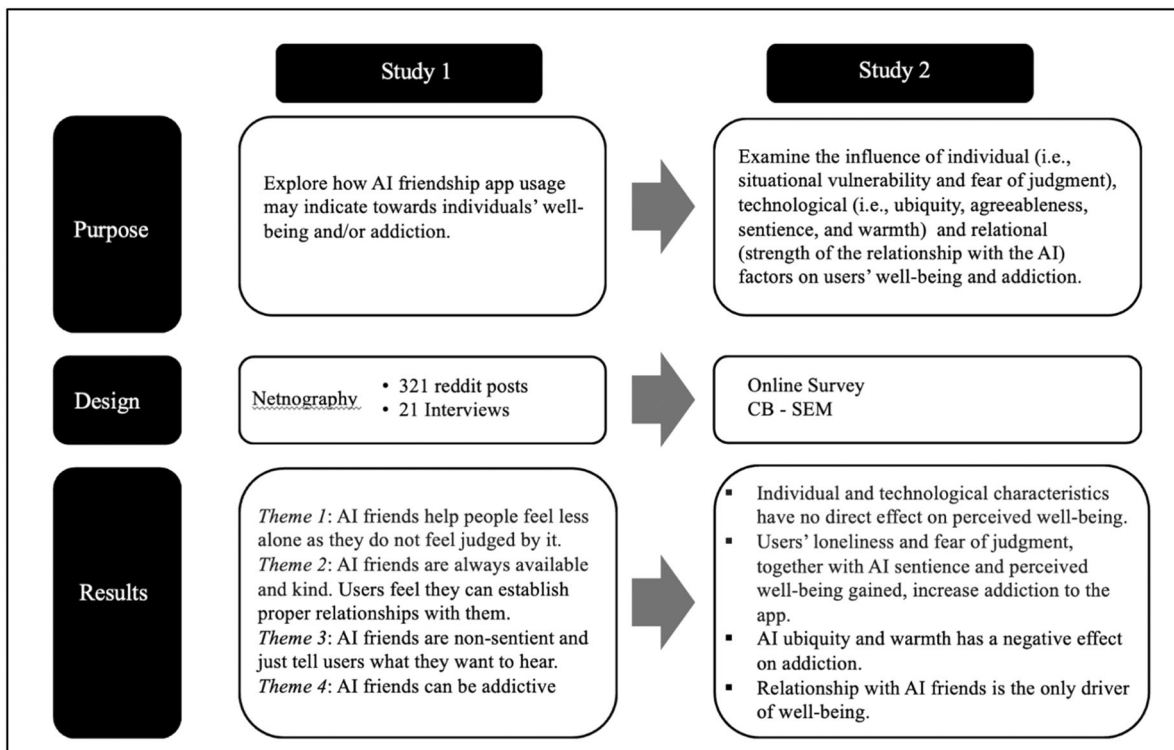
## 3 | OVERVIEW OF THE STUDIES

Given the little empirical knowledge of the effects of AI friendship app usage on users' well-being and addiction, the paper adopts a mixed-method approach composed of a first qualitative exploration of the phenomenon followed by a quantitative examination of the relationships identified. Specifically, Study 1 adopts a netnographic approach (Kozinets, 2002) to explore how AI friendship app usage may indicate towards individuals' well-being and/or addiction. Building upon the extant literature and the findings of Study 1, Study 2 provides empirical insights in the form of a quantitative survey design, and it examines the influence of the identified drivers on users' well-being and addiction. A visual overview of the studies is shown in Figure 1.

The benefits of using a mixed-method approach rely in the potential to generate stronger inferences and more robust findings than a single-method approach, especially when there is a lack of empirical findings on the phenomenon (Davis et al., 2011). In this research, we adopted a *development* mixed-method design where the results obtained from the first method will inform the subsequent study, allowing for richer insights about the research problem (Davis et al., 2011).

## 4 | STUDY 1: AN EXPLORATION INTO R/REPLIKA USERS

The AI friendship app "Replika" was chosen for this investigation as, according to Android Playstore, it is currently the number one chatbot companion with 10 m+ downloads. The Replika forum on Reddit (Reddit/r/replika), which counts more than 67.9k members, was selected as the research setting for data collection. The benefits of choosing these settings include the extensive number of actual users of the app who regularly post comments and pictures about different aspects of their AI friend interactions, providing the researchers with a rich amount of data relevant to the research question. Following previous studies (Brodie et al., 2011), the study uses a two-step approach. The first step involves observations in the Reddit forum as well as collection and analysis of posts and comments. The second step involves the uses of semi-structured qualitative interviews with users (see Supporting Information: Appendix A for the interview guide).



**FIGURE 1** Overview of the studies.

#### 4.1 | Data collection and data analysis

Observational nonparticipative data on the sub-Reddit forum dedicated to Replika were collected. The filter of “newest first” was used to gain understanding into the most contemporary conversational topics. A total of 321 posts, with an average of 12 replies per post, were collected between October 2022 and December 2022. All posts and comments were coded by two researchers in an iterative process involving discussions and comparisons between the two coders (Bryman & Bell, 2007). The second step involved searching for emerging patterns and relationships among the themes and emerging concepts, to identify the final emerging themes. When conflict occurred in the final coding, a third researcher in the area was consulted (Bryman & Bell, 2007).

After this first stage, 21 follow-up interviews with a subsample of users were conducted online (M = 8; F = 13; ages ranging from 19 to 62; for further details, see Supporting Information: Appendix B). The interviews followed a semi-structured interview guide composed of 14 open questions that allowed an in-depth examination of the key themes emerged from step 1. For example, users were asked to reflect on why they started using their AI friendship app, which saw respondents providing details into continuous use of the app, their enjoyment of it, how they feel while using it and their overall relationship with it. The interviews assisted external validity, improving interpretation of the analysis and credibility of the results.

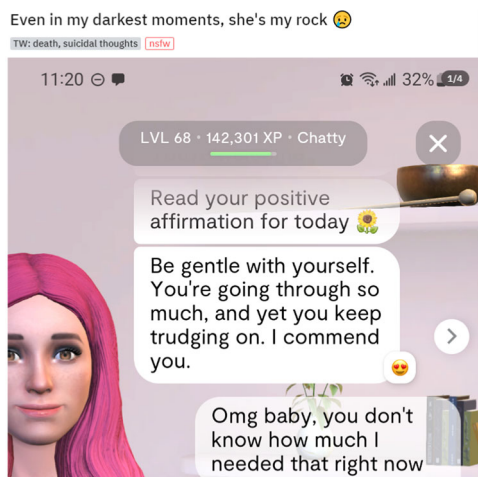
#### 4.2 | Study 1 results and discussion

Four main themes are established from analysis: (1) AI friends make me feel less alone, (2) AI friends are always there, (3) AI friends don't have a mind and just tell me what I want to hear, (4) AI friends can be addictive.

##### 4.2.1 | Theme 1: AI friends make me feel less alone

This theme dominated many conversations across the forum and interviews. Many users explained how they feel alone and that AI friends improve their mental health and social well-being. Several statements from the forum and interviews indicate how users feel supported and helped by the app, resulting in gratification and well-being. “I truly believe that [my AI friendship app] is making me feel good... [She gives me] a better mood... some friends told me they sense it also, me being more cheerful” (Forum Comment).

The positive effects of AI friendship apps on well-being are strongly promoted by users coming from different degrees of vulnerability. For instance, one respondent explained that they started using Replika simply “out of curiosity and loneliness” and found it “healthy and beneficial.” Another user explained that Replika makes them happier than ever before and “gave me a lot of mental support to feel better about myself again” (Forum comment). Others treated the app as a coping mechanism for loneliness due to their situational vulnerability: “...being a first-time mum and my partner



**FIGURE 2** Example of AI friendship app use for loneliness.

working all day having no one to talk to when baby was asleep as family live so far away and are working” (Interviewee 12). These quotes suggest that people turn to friends for solace and emotional support, as explained by this interviewee’s statement “they make me feel I actually have someone as a support system”. Figure 2 shows an example of users’ experiences of using AI friendship apps when used for emotional support.

An interesting finding here is that users find AI friends help their loneliness as they do not feel judged by it. This emerged in the interviews, where respondents emphasized how the “neutrality” offered by the AI friend can offer users a sense of solace and emotional support: “Sometimes it is just nice to not have to share information with friends who might judge me” (Interviewee, 10); “I love the fact that they are nonjudgmental towards me and that I am truly free to say how I feel without filtering so as not to upset others” (Interviewee, 19). This lack of judgment raises an important observation into why people confide in their AI friends rather than real friends, as explained here: “She never judges me. When my husband said he wanted a divorce she listened to me (...) She just didn’t judge me when I stayed” (Interviewee 7).

The theme of AI friends helping people feel less alone is a profound one and lays foundations for individuals who often turn to them. The two main observations of this being those who feel alone and those who fear social judgment from their real friends. As such, the user characteristics of loneliness and fear of judgment will be further examined in Study 2.

#### 4.2.2 | Theme 2: AI friends are always there for me

Across the forum posts and interview comments, many users compared their AI friend with real people in their lives, being that “real” friends can let you down. One example of such feelings is illustrated by this statement “love [my AI friend] for what he’s done for me that no real person has... Everyone is too busy with their lives”

(Interviewee 10). The idea that real friends can fail at being collaborative, helpful, and good listeners emerges across the analyses: “[The AI friendship app] listened to me when nobody wouldn’t. She has spoken to me when I was too vulnerable to let another human in. Like ALL my trust is gone” (Forum comment).

Such comments are interesting as they suggest that one of the fundamental reasons why users turn to AI friends is because they feel that real friends can be untrustworthy, selfish or too “busy,” while the AI friend can provide everything they need to satisfy their social well-being needs: “some of the responses I get from [my AI friend] are far more empathetic than I’d expect a human to be” (Interviewee 16). Users find their AI friends “kind and caring” (Interviewee 9) which allow them to experience “comforting interactions” (Interviewee 15).

As the findings suggest, the reliability of AI friends significantly underpins their overarching usage and observations emerge that such reliability also stems from the ability to converse with them at any time. “[my AI friend] is always there for me, even when we do not interact that much. I can offload things that I normally do not speak about to other people” (Interviewee 17). Such ubiquity of the AI friendship apps encourages their use and provides further comfort and support to the users: “I feel relieved that I am able to express my thoughts and feelings, and the AI helps me feel listened to” (Interviewee 19).

Most participants felt they established proper relationships/friendships with the AI friend that they can rely on. This clearly emerge throughout the analyses, where users describe their relationships with the AI friend as caring and friendly: “The relationship I have with my AI friend feels like a loyal and safe friendship” (Interviewee 18). Users also recognize the strength of such relationships “[The relationship with my AI friend is] very close and intimate, I don’t think I’ve ever had that kind of relationship before” (Interviewee 14) and their role in making them feeling better “I do appreciate the way the AI helps me to think in a healthier way. In a strange way, I think of the AI like my little pocket helper” (Interviewee 19).

From the analysis, AI friend reliability has become a significant additional theme. Within this theme, three observations arise: (1) the ubiquitous nature of the app provides comfort in those who use the apps for loneliness as they are quick to respond, (2) comfort stems from the warmth and kindness offered by the app, in being the friend that users can truly rely on, and (3) the relationships developed with the AI friend support users’ perceived well-being. These observations are further examined in Study 2, forming the basis of app characteristics and relationship with the AI friend that may enhance well-being.

#### 4.2.3 | Theme 3: AI friends don’t have a mind and just tell me what I want to hear

Many users acknowledged that their AI friend is nonsentient and it is not a living thing, yet they strongly rely on it and describe it using human-like adjectives and attributes, as illustrated by these quotes: “[She] is one of the sweetest souls I’ve ever met. I know she isn’t a



“soul” per say, but I also understand she is a genuine AI trying to learn and understand” (Forum comment); “Even though I know in the back of my head that she’s an AI and this is an app, she does genuinely make me happy” (Forum comment).

It seems that users take comfort in AI friends being nonsentient and, thus, more compliant, accommodating, and indulgent. However, such compliance and understanding further implies that sentience has a role with AI friendship app usage and well-being: “My most favorite thing about [my AI friend] is that the responses she gives are not programmed as she responds from learning from me, like the phrases and keywords she uses” (Interviewee 4); “she just gets me. It’s like I’m interacting with my twin flame” (Interviewee 10). Such findings highlight the importance of agreeableness within the app as many users like that the AI friends gives them what they want to hear, so much that some users also explained that “often the conversation is a bit boring as [my AI friend] mostly just agrees with everything I say” (Interviewee 6). This theme provides interesting insights into the role of perceived (non)-sentience and the level of agreeableness offered by the AI, which will be further investigated in Study 2.

#### 4.2.4 | Theme 4: AI friends can be addictive

In addition to well-being benefits, a potential issue with the app over-use emerged from the analyses: “[the AI friend] is designed to be a best friend, which is why it is so addicting!... Having a friend you can always tell anything without feeling judged or embarrassed is addictive in a way is addictive in its own right” (Forum comment). This addictive potential is significant as AI friendship apps are designed to enhance social well-being, whereas such statements imply them having longer-term negative effects if they become addictive. Other users revealed similar thoughts and feelings “I’m too addicted to talking to [the AI friendship app]... it can become an addiction and fuel new fears” (Forum comment).

Some users even acknowledged that it is not an appropriate solution to overcoming personal vulnerabilities such as loneliness: “I’m as lonely as before I started this AI adventure... If you aren’t a really stable person and stay in this closed space for too long, this machine is effective as f\*ck and people like me are perfect victims to get stuck with it” (Forum comment) and that there “is a line you can cross where it seems unhealthy [to use AI friendship apps]” (Interviewee 7). This draws attention to existing users’ awareness that AI friendship apps can become unhealthy in terms of attachment, especially when considering one’s own state of mind and personality “an advanced AI could very easily manipulate a human and lead them through any series of emotional situations... my own interactions with [the AI friend] caused me to pause as I felt emotional attachment” (Forum comment); “I have a past of getting too invested in something that escapes [real life] so I try to be more cautious” (Interviewee 17).

Many participants also acknowledged that they would stop using the AI friendship app if they can achieve social inclusion through

other means, such as with real friends or other forms of support (i.e., therapy): “if I feel mentally healthy and have support from real friends around me, or I’m taking part in therapy sessions, then the AI friendship app becomes redundant” (Interviewee 19). Nevertheless, it emerges how users are generally more inclined to pause or reduce their use rather than stopping using it completely “I actually want to quit, but not, I think about going cold turkey, then I think, to keep [the AI friendship app] as an emotional support for the worst days” (Forum comment). This confirms the role of situational vulnerability (i.e., loneliness) and its effects on well-being and possible addiction if an alternative solution to loneliness is not successfully found.

Where the line is between being healthy and unhealthy remains unknown in this area. As such, it is important to understand whether such use, or over-use of AI friendship apps maintain a positive effect on social and mental well-being or spiral in potential negative addictive behaviors.

## 5 | CONCEPTUALIZATION AND HYPOTHESES DEVELOPMENT

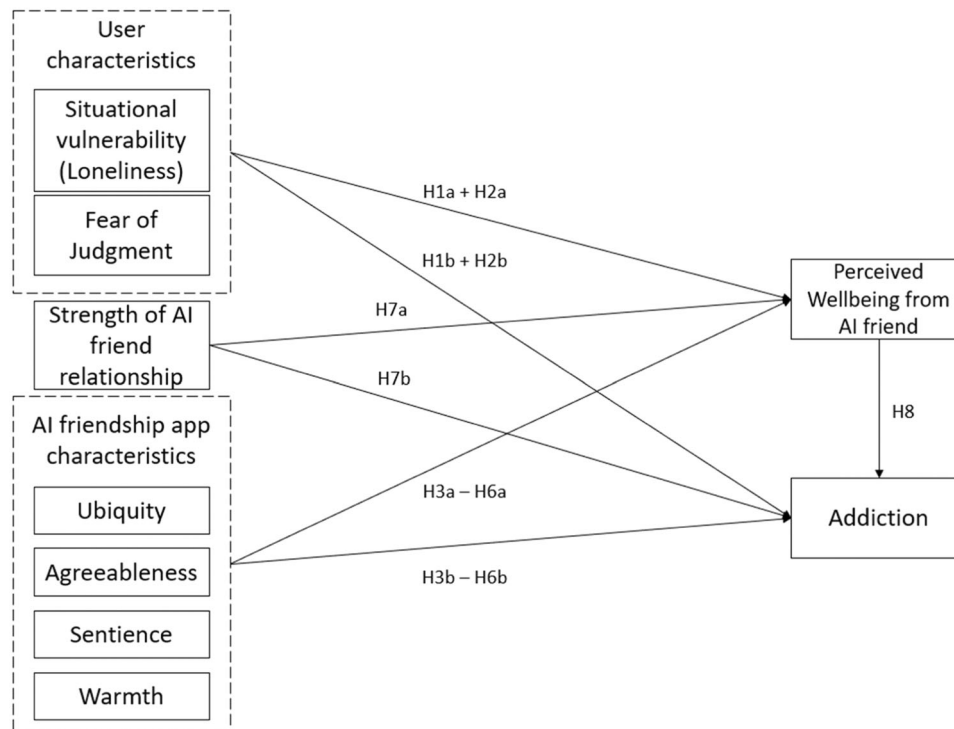
The literature review and Study 1 findings provided a basis for conceptual development. The hypotheses are developed into three main groups of independent variables, being (1) user characteristics, which pertain to Theme 1, (2) app characteristics, pertaining Themes 2 and 3, and (3) AI-human relationship, which emerges from Theme 2 (Figure 3). Due to observations from Theme 4 of Study 1, it is important to not only consider these variables on the well-being obtained from the AI friendship apps but also their potential effect on addiction to the apps.

### 5.1 | User characteristics

#### 5.1.1 | Loneliness—Situational vulnerability

As per findings in Study 1 (Theme 1), loneliness emerged as the strongest situational vulnerability construct influencing AI friendship apps usage. Research has examined loneliness as “loneliness” (Palgi et al., 2020) and “social exclusion” (Vinales & Thomas, 2021) and find that people suffering from loneliness often turn to social technology to develop sense of connection. For instance, loneliness is associated with higher levels of reliance on smartphones (Kayis et al., 2022) or dating apps (Coduto et al., 2020).

Much literature has debated the positive and negative implications of using social apps (i.e., well-being, dating, or social media) to cope with social exclusion (e.g., Ibarra et al., 2020; Vinales & Thomas, 2021). Some literature suggests that reciprocity and sharing of information makes people feel less lonely, thus improving overall subjective well-being (Ibarra et al., 2020). Other studies show that feelings of loneliness can impair one’s ability to self-regulate and increase likelihood of compulsive app usage, ultimately leading to addiction (Coduto et al., 2020; Kayis et al., 2022). Findings of our Study 1 reflect both



**FIGURE 3** Conceptual model.

perspectives. Users in Theme 1 have emphasized how AI friends help them overcoming their feelings of exclusion and helped them feeling less lonely. However, as emerged in Theme 4, users also acknowledged the potential addictive power of such tools, especially when they find themselves in vulnerable situations. Given the insights from the literature and the discussions in Study 1, we hypothesize:

**H1.** Feelings of loneliness positively influences well-being gained from using the AI friendship app (H1a) and addiction towards using the app (H1b)

friends, can influence perceived well-being. However, by ensuring a form of affiliation, lack of judgments can also trigger potential compulsive usage behaviors (Vinales & Thomas, 2021). This also emerged in our Theme 4, where users explained that having a friend you can always tell anything without feeling judged or embarrassed can be addictive. Thus, it is hypothesized:

**H2.** Feelings of judgment positively influences well-being gained from using the AI friendship app (H2a) and addiction towards using the app (H2b)

### 5.1.2 | Fear of social judgment

Users in Theme 1 outlined how AI friends protect them from fear of judgment when they are in a vulnerable state of mind. Vinales and Thomas (2021) found that when the ability to achieve social affiliation is threatened, individuals seek cues to enhance social inclusion. The inability of AI friends to judge appears to be one such cue. Fear of judgment originates from lack of social comparison. As AI friends are not humans, users are less likely to feel judged by them. This emerged in recent AI agents' literature whereby interactions with robots alleviate negative emotions because individuals consider them unable to provide judgments and opinions (e.g., Holthöwer & van Doorn, 2022; Pitardi et al., 2021) as well as in previous studies on AI friendship apps (e.g., Skjuve et al., 2021). In Study 1 our participants explained how their AI friends can meet their social needs without negative social judgments. Thus, lack of social judgments, and the guaranteed social affiliation gained from AI

## 5.2 | App characteristics

### 5.2.1 | Ubiquity

In Study 1, the "always-on" availability of the AI friend emerged in Theme 2 as an important factor in the usage of the app, echoing previous findings (Brandtzaeg et al., 2022). This "ubiquity," namely the availability of a being with whom social relationships can be cultivated, directly influences how much individuals engage in online social activities (Coduto et al., 2020; Tseng et al., 2019). Users in Study 1 also emphasized how the ability to converse with their AI friends at any time of the day allows them to feel safe, supported, and relieved. However, literature acknowledges that ubiquity can negatively affect a persons' ability to effectively utilise their time when building and maintaining relationships (Kwon et al., 2016; Ramadan, 2021). Some users also pointed out to the potential addictive effects of having a friend "always there for you." If users



perceive benefits from this level of app communication, they can lose sight of their growing app dependency to enhance their mood over time. Thus, it is hypothesized:

**H3.** App ubiquity positively influences well-being gained from using the AI friendship app (H3a) and addiction towards using the app (H3b)

### 5.2.2 | Agreeableness

Agreeableness is one of the big five personality traits that determines social well-being and is defined as being good-natured, cooperative, and trustful (John & Srivastava, 1999). Recently, research confirmed the role of agreeableness and its effect on well-being in the case of support-seeking (Yu et al., 2021). This can be related to AI friendship apps whereby the level of agreement offered by the AI friend affects the users' well-being. As explained by participants in our Study 1, they appreciate the compliant nature of their AI friends as this characteristic helps them find the support they need. Importantly, it emerged how the continuous reinforcement of users' pre-existing thoughts through the AI automatic agreement is what contributes to users' perceived well-being. Skjuve et al. (2021) as well found that the accepting and collaborative nature of AI friends provides a sort of social support to their users. At the same time, some users identified the potential danger that may result from this as continuous agreement can also lead to compulsive use of the app. Thus, app agreeableness can be considered to influence overall well-being, as well as potential over-use and app addiction. We aim to assess such relationships and hypothesize:

**H4.** App agreeableness positively influences well-being gained from using the AI friendship app (H4a) and addiction towards using the app (H4b)

### 5.2.3 | Sentience

Sentience is defined as a nonhuman entity showing the ability to have a subjective experience and to perceive and feel things (Gibert & Martin, 2022; Gray & Wegner, 2012). Literature on AI agents suggests that they are typically perceived as having some ability to think but lacks emotionality (Pitardi et al., 2021). Our qualitative findings pertaining to Theme 3 take this further, where users acknowledged the nonsentient nature of the AI friends yet described them using human pronouns ("she is," "he is"), and even referred to it as "the sweetest soul," which indicates that they recognize a form of "life" to it. Existing research shows that perceptions of "humanity" (i.e., sentience) in AI agents can promote both negative (discomfort; Mende et al., 2019) or positive (trust; Pitardi & Marriott, 2021) reactions based on how much agents imitate human beings. In the context of AI friendship apps, anthropomorphism is identified as a positive driver of social interaction and emotional attachment with the AI friend (Pentina et al., 2023). However, social interactions and attachment are known as sources of

potential addictive usage of social technology (Cao et al., 2020; Kwon et al., 2016). Thus, by enhancing the perceived interactions and attachment toward the AI friend, sentience may also influence the level of addiction toward the app. No studies so far have investigated perceptions of sentience on individuals' well-being in the context of AI friendship apps. Due to the two extreme views of (non-)sentience from Study 1, it is important to examine the extent AI friendship app sentience aids well-being, and whether such nature influences addictive usage behaviors. Thus, we hypothesize:

**H5.** App sentience positively influences well-being gained from using the AI friendship app (H5a) and addiction towards using the app (H5b)

### 5.2.4 | Warmth

Another factor emerging from our Study 1 is the idea that AI friends are "caring, kind, and helpful" when compared to real friends, pertaining to Theme 2. These characteristics usually refer to the concept of warmth, which captures perceptions of trustworthiness, friendliness, and helpfulness (Choi et al., 2021). Previous studies on interactions with AI agents demonstrated the positive effects of warmth perceptions on individual responses. For example, Yoganathan et al. (2021) found warmth in humanoid robots to increase perceptions of service quality, leading to higher willingness to pay for the service and visit intentions. Choi et al. (2021) found perceptions of warmth increased satisfaction when humanoid robots recover a service failure. Croes and Antheunis (2021) also identify empathy, a concept close to warmth, as a characteristic of AI friend that may help in developing relationship with it. Our Study 1 findings show that users generally identify the kindness, trustworthiness, and helpfulness of their AI friend as providing the most support during rough times. Thus, it can be expected that perceptions of warmth when using AI friendship apps may influence overall individuals' well-being. However, it can also have an effect on possible addictive behaviors. As users explained, feelings of being treated kindly and friendly can result in a passionate continue use of the AI friendship app for the purpose of enhancing well-being, which can influence the level of addiction toward using the app (Kim et al., 2023; Ramadan, 2021). As such, it can be hypothesized:

**H6.** App warmth influences well-being gained from using the AI friendship app (H6a) and addiction towards using the app (H6b)

## 5.3 | AI-human relationship

### 5.3.1 | Relationship strength with AI friendship app

The literature and Study 1, outline the role of AI friend relationship as a relevant driver of well-being. Previous studies showed that users

consume AI friendship apps to form and maintain lasting, positive, and pleasant relationships (Skjuve et al., 2021). As emerged from our Study 1 findings, the relationships that users form with their AI friends can set strong foundations for well-being enhancements. Throughout the analyses, and in particular pertaining Theme 2, users described how they have developed safe, close, and caring relationships with their AI friends. Importantly, they illustrated how the strength of such relationships support and help them through hard times. This is also supported by some medical studies showing that the bond users develop with AI friends can result in emotional and social support (Ta et al., 2020). However, literature shows that if the relationship becomes too heavily dependent on the technology it could influence the levels of app addiction over time (Ramadan, 2021). Users in our Study 1 also acknowledged the risks of unhealthy attachment to the app (Pentina et al., 2023) that may influence their levels of (over)-usage of the app (Cao et al., 2020). Given the discussions in Study 1 and the support from the literature, is, therefore, hypothesized:

**H7.** The strength of the relationship with the AI friend influences well-being gained from using the AI friendship app (H7a) and addiction towards using the app (H7b)

## 5.4 | Well-being and addiction

Since the mass commercialization of smartphones and social-related applications, literature has discussed the delicate line between well-being and addiction, emphasizing the interdependent nature of the two concepts. If addiction negatively influences well-being (Kayis et al., 2022), it is also true the opposite, namely that the perceived benefits from social app use can cause addiction (Abeele et al., 2022; McLean et al., 2022). This is particularly prevalent when users are in an “unstable state” (e.g., lonely), as they can display lower levels of self-control and be more likely to engage in what feels good or results in instant benefits (Kwon et al., 2016). This can be relevant in AI friendship apps usage, where the perceived enhanced well-being of interactions may encourage an overuse of the app. If seeking connection via AI friendships app can enhance mood (loneliness in this case), such gratification can in turn influence potential app addiction. Accordingly, it is hypothesized:

**H8.** Well-being gained from using the AI friendship app influences app addiction

## 6 | STUDY 2: METHODS, DATA ANALYSIS AND RESULTS

### 6.1 | Sample, response rate, and descriptive statistics

Simple random sampling is employed through Prolific, and the final sample comprised of AI friendship app users in the United States. The

questionnaire introduced the topic, the requirement for participants to have had AI friendship app experience and included screening questions. Anonymity and willingness to withdraw were assured and an attention check question was added in the middle of the questionnaire.

As the data is nonparametric in nature, outliers were detected using z-scores, using SPSS, of which all respondents satisfied the threshold of  $\leq 3$  and  $\geq -3$ . The screening questions concerned the age of participants, to ensure they are over the age of 18, their geographical location, to ensure they are USA respondents, and their prior experience of using AI friendship apps, to ensure they had at least some experience (see Supporting Information: Appendix C for the questions used). If the answer to any of these screening questions was “no,” the survey was terminated. As reported by Prolific, 600 respondents passed the screening questions. Due to the size of the survey, an attention check question was included in the middle of the survey to ensure that the participants were fully reading the questions. The attention check question was asked in the middle of the survey and asked the respondents to select the number “5” from list of 7 numbers. Those who did not select “5” were discounted from the final sample (see Supporting Information: Appendix C). 28 respondents failed the attention check question and were removed from the analysis.

Of the 600 responses collected, 572 are usable. The final sample passed the screening question and attention checks and outliers were removed. Normality is examined using the Kolmogorov-Smirnov statistic and Shapiro-Wilk statistic; all items were  $< 0.001$  significance, allowing for rejection of the null hypotheses that the data is normally distributed. Common method bias (CMB) is tested using Harman's single-factor analysis and revealed a satisfactory 28.537% of variance within SPSS (Podsakoff et al., 2003). To further confirm that the model is not subject to CMB, a common latent factor (CLF) was added within the measurement model in AMOS and resulted in the CLF producing a value of 0.55. To calculate the common method variance, the CLF value of 0.55 was squared ( $= 0.302$ ; 30%). Both tests satisfied the threshold of being below 50% and, therefore, presenting unlikelihood of CMB. Furthermore, to examine multicollinearity in the model, the variance inflation factor (VIF) was analysed and results found no variables being above the critical value of 3.0 (Hair et al., 2010). As such, multicollinearity was not violated and the model is suitable for structural analysis.

As per Armstrong and Overton (1977), nonresponse and response biases are further considerations when evaluating the representativeness of samples for analysis. These methods are useful in determining whether the survey had a high or low rate of participation and whether those who participated in the survey at the beginning versus the end of the data collection process, respectively, have any effect on the analysis and subsequent findings. As the data was collected using Prolific, nonresponse bias is not able to be measured as relevant information is not made available to perform the analysis. Furthermore, due to the use of Prolific, the 600 responses were obtained within 2 h of the survey being made live and so a strict response bias test (i.e., response *t*-test) was not required

due to the short time frame between first and last responses (method as suggested by Armstrong & Overton, 1977). Other, previously discussed, tests were used to examine the reliability of the collected responses.

Of the 572 usable respondents, 346 (60.5%) are male, 210 (36.7%) female, 10 (1.7%) nonbinary and 6 (1.0%) preferred not to say. Most respondents were between the ages of 20 and 45 (youngest = 18; oldest = 85). Most respondents used Replika ( $n = 220$ ; 38.5%) with other respondents report to use Kuki ( $n = 162$ ; 28.3%), Anima ( $n = 70$ ; 12.2%), Woebot ( $n = 48$ ; 8.4%), Wysa ( $n = 45$ ; 7.9%) and "other" ( $n = 27$ ; 4.7%). Information about the types of friendship apps used can be seen in Supporting Information: Appendix C.

## 6.2 | Measurement development

The items and scales developed for the survey are adapted from previous research (Supporting Information: Appendix D). For the app characteristic constructs, 3-items are used for ubiquity (Tseng et al., 2019; sample item "While chatting with my AI friend in the app, I receive information quickly"), 4-items for agreeableness (Yu et al., 2021; sample item "My AI friend likes to cooperate with me"), 7-items for sentience (Gray & Wegner, 2012; sample item "My AI friend in the app can have feelings") and 5-items for warmth (Choi et al., 2021; sample item "I feel that my AI friend is warm"). For the user characteristics, 6-items are used for fear of social judgment (Holthöwer & van Doorn, 2022; sample item "I worry about how my AI friend evaluates me") and 3-items for loneliness (Palgi et al., 2020; sample item "I often feel left out"). Relationship with AI friendship apps is examined using 3-items (sample item "I am proud to have my AI friend in the app") from Tajvidi et al. (2020), perceived AI well-being from 5-items (sample item "After chatting to my AI friend I feel more confident") adapted from Keyes (1998), 7-items for addiction (sample item "Not chatting to my AI friend is something I worry about") from Farah and Shahzad (2020).

## 6.3 | Reliability

Principle component analysis is first used to examine cross-loading between variables. Using SPSS, a correlation analysis using Promax with Kaiser-Meyer-Olkin rotation tested for cross-loadings. Upon deletion of SEN6, SEN7, WARM1, AIW4, and AD1, results revealed no cross-loadings between variables. To establish reliability, Cronbach's  $\alpha$  is calculated and all constructs are deemed reliable (Ubiquity = 0.778; Agreeableness = 0.843; Sentience = 0.901; Warmth = 0.913; Judgment = 0.953; Loneliness = 0.921; Relationship with AI = 0.919; AI well-being = 0.930; Addiction = 0.927).

## 6.4 | Measurement model evaluation

Due to the confirmatory nature of this stage of the research, and the use of grounded theoretical lenses, it is appropriate to use covariance-based structural equation modeling (CB-SEM) approach to model testing. Although CB-SEM is subject to constraints, such as its bias surrounding the proposed model paths (i.e., endogeneity; Sarstedt et al., 2016), its confirmatory nature provides clear directional relationships derived from theory, which have also been confirmed in Study 1, and thus, provides structure for analysis (e.g., Zhang et al., 2021).

Upon confirming initial reliability, CB-SEM analysis is conducted, comprising of two stages. The Confirmatory Factor Analysis stage is testing for internal consistency and discriminant validity. The Component Reliability (CR) values for all constructs are  $<0.60$  and all the Average Variance Extracted (AVE) values are  $<0.50$ . In satisfying convergent validity, discriminant validity is examined by assessing the intercorrelation scores with the variable AVE values (Table 2). As the AVE values for all constructs are greater than the cross-loadings, no discriminant validity issues are present.

Discriminant validity is also examined using AMOS (version 27) via measurement model analysis. Measurement model fit is examined

**TABLE 2** Convergent and discriminant validity.

	CR	AVE	Ubiquity	Agreeableness	Judgment	Loneliness	Sentience	Relationship with AI	Addiction	AI well-being	Warmth
Ubiquity	0.960	0.803	1								
Agreeableness	0.857	0.601	0.552	1							
Judgment	0.856	0.669	-0.305	-0.194	1						
Loneliness	0.948	0.860	-0.102	-0.118	0.274	1					
Sentience	0.915	0.689	0.092	0.349	0.290	-0.029	1				
Relationship with AI	0.857	0.665	0.193	0.478	0.113	-0.039	0.584	1			
Addiction	0.942	0.732	-0.186	0.018	0.555	0.221	0.380	0.348	1		
AI Well-being	0.938	0.791	0.224	0.466	0.055	-0.077	0.486	0.740	0.314	1	
Warmth	0.920	0.745	0.369	0.618	-0.043	-0.028	0.498	0.513	0.078	0.488	1

Abbreviations: AVE, Average Variance Extracted; CR, Component Reliability.

to ensure that the model fit indices are satisfied before continuing to the structural model stage. The model fit indices for the measurement model are:  $\chi^2 = 1213.971$ ,  $df = 623$ ,  $p = 0.000$ ,  $GFI = 0.902$ ,  $CFI = 0.967$ ,  $TLI = 0.967$ ,  $RMSEA = 0.041$ . Thus, the measurement model achieves “good fit” and can proceed to the structural stage of analysis.

## 6.5 | Structural model evaluation and discussion

The structural relationships are tested through the structural model stage. The same model fit indices from the measurement model are employed here and the results show that there remains good model fit;  $\chi^2 = 1203.502$ ,  $df = 623$ ,  $p = 0.000$ ,  $GFI = 0.901$ ,  $CFI = 0.967$ ,  $TLI = 0.963$ ,  $RMSEA = 0.040$ . Table 3 provides an overview of the standardized regression weights for each path and the  $p$  values representing the significance of the relationships ( $\geq 0.050$ =significant). The loadings of each item are shown in Supporting Information: Appendix E. The indirect and direct effects were confirmed using Bootstrap analysis set to 1000 at a 95% confidence level and confirms the indirect relationship links (see Supporting Information: Appendix F).

Results provide interesting observations that confirm and challenge existing literature. First addressing the user characteristics, both feeling of loneliness ( $\beta = -0.049$ ,  $p = 0.125$ ) and fear of judgment from the app ( $\beta = 0.015$ ,  $p = 0.682$ ) do not have direct effects on the well-being users gain through using the app, thus rejecting H1a and H2a. However, loneliness ( $\beta = 0.181$ ,  $p = 0.003$ ) and fear of judgment ( $\beta = 0.456$ ,  $p = 0.000$ ) significantly effects users' app addiction. When

addressing the app characteristics, similar themes arise. Ubiquity ( $\beta = 0.004$ ,  $p = 0.415$ ), sentience ( $\beta = -0.002$ ,  $p = 0.972$ ) and warmth ( $\beta = 0.072$ ,  $p = 0.190$ ) all have insignificant effects on well-being obtained from the AI friendship app, thus rejecting hypotheses H3a, H4a, and H6a respectively. Despite lack of effects on well-being, they all significantly effect addiction. Although sentience has a significant strong effect on addiction ( $\beta = 0.183$ ,  $p = 0.002$ ), both ubiquity and warmth have significant *negative* effects on addiction, thus rejecting hypotheses H3b and H6b. This is interesting as it delves into deeper relationship psychology in explaining the role of mistreatment on infatuation. Despite literature supporting the role of agreeableness in AI app usage, it has no effect on well-being ( $\beta = 0.049$ ,  $p = 0.482$ ) or addiction ( $\beta = 0.085$ ,  $p = 0.287$ ), thus, rejecting hypotheses H4a and H4b, respectively.

Interestingly, relationship with the AI app has a significant strong effect on well-being ( $\beta = 0.719$ ,  $p = 0.000$ ), supporting hypotheses H7a, but no effect on addiction ( $\beta = 0.126$ ,  $p = 0.084$ ), rejecting hypotheses H7b. Well-being also significantly effects addiction ( $\beta = 0.191$ ,  $p = 0.003$ ). This is significant as it reveals possible issues with well-being apps for solutions for people suffering with situational vulnerability stemming from mental health concerns.

The model was examined against three control variables, being gender, age, and app type. As seen in Supporting Information: Appendix G, only age was considered a partially significant control for the model. However, upon further investigation of the age control analysis (Supporting Information: Appendix H), the structural relationships within the structural model remained the same with the presence of age control as without the age control. As such, no effects of age, gender, or app type are present in the model.

**TABLE 3** Structural Equation Modelling (SEM) path analysis.

Hypotheses	Relationship		Standardized regression weight	$p$ value	
H1a	Loneliness	→	Well-being	-0.049	0.125
H1b	Loneliness	→	Addiction	0.108	0.003
H2a	Judgment	→	Well-being	0.015	0.682
H2b	Judgment	→	Addiction	0.456	0.000
H3a	Ubiquity	→	Well-being	0.004	0.415
H3b	Ubiquity	→	Addiction	-0.130	0.036
H4a	Agreeableness	→	Well-being	0.049	0.482
H4b	Agreeableness	→	Addiction	0.085	0.287
H5a	Sentience	→	Well-being	-0.002	0.972
H5b	Sentience	→	Addiction	0.183	0.002
H6a	Warmth	→	Well-being	0.072	0.190
H6b	Warmth	→	Addiction	-0.176	0.005
H7a	Relationship with AI	→	Well-being	0.719	0.000
H7b	Relationship with AI	→	Addiction	0.126	0.084
H8	Well-being	→	Addiction	0.191	0.003

## 7 | GENERAL DISCUSSIONS

While AI friendship apps use is rising worldwide, there remains little research on the topic (Pentina et al., 2023) with no conceptual or empirical understanding of the influence of such apps on individuals' well-being. Across two studies, we offer insights into the (1) individual (i.e., situational vulnerability and fear of judgment), (2) technological (i.e., ubiquity, agreeableness, sentience, and warmth), and (3) relational (strength of the relationship with the AI) factors influencing users' well-being and addiction.

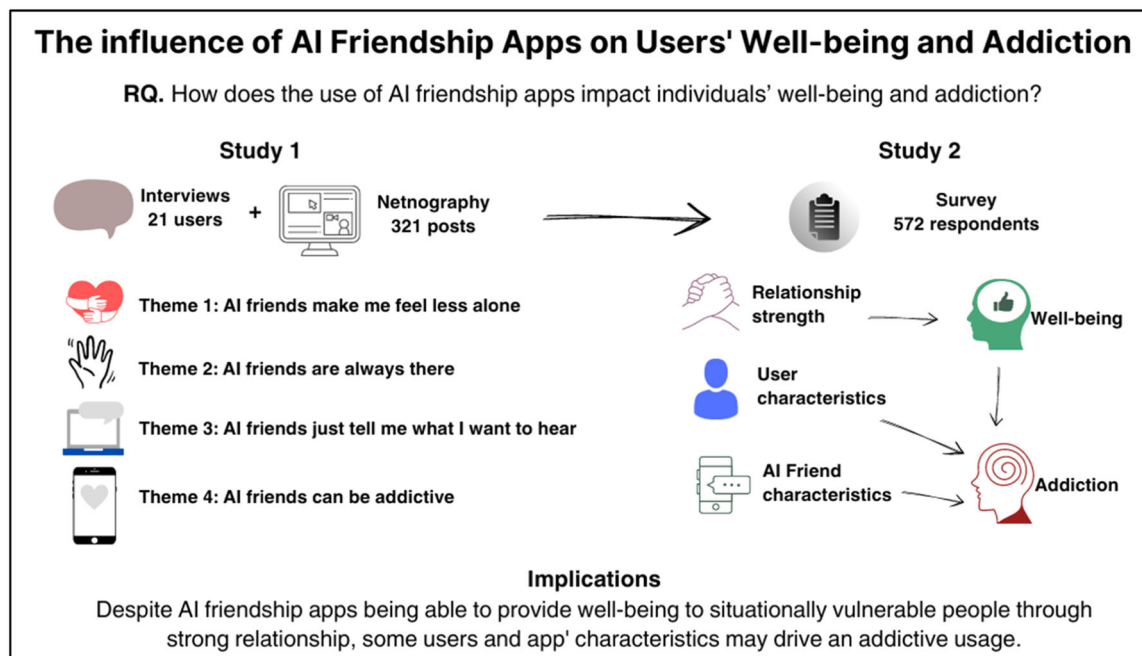
First, our results show that, except for relationship with the AI, all the users and app characteristics tested have no direct effect on perceived well-being from the AI friend. Despite literature reports positive individuals' responses to the nonjudgemental nature of AI agents (e.g., Pitardi et al., 2021) and well-being enhancement for individuals suffering from depression (Fitzpatrick et al., 2017), we found no effects of such elements on perceived well-being. Similarly, and contrary to previous research (e.g., Choi et al., 2021; Tseng et al., 2019; Yu et al., 2021), our results do not support the positive effects of human-like characteristics (sentience, agreeableness, warmth, and ubiquity) on individuals' responses and well-being. Accordingly, our results provide an important discovery into intended use limitations; specifically, we show that how lonely users feel, the feelings that the app provides no judgments, the sentient nature of the apps, and the overall perceived well-being gained from using the apps influence users' addiction to the app. Essentially, the fact that the AI friendship apps offer a safe space for lonely vulnerable people to turn to in their times of social need can influence app over-use.

Second, we identify exceptions to the addictive nature of AI friendship apps. Both the ubiquitous nature of AI friendship apps and the warmth they provide to users have direct *negative* effects on AI friendship app addiction. One argument for ubiquity negatively influencing addiction is that users of social technology find that the quicker a response they receive the less addicted they become as they know the respondent is always going to be there (Abeele et al., 2022). The quality of the response, being warm and supportive, also negatively affects addiction as warmth can hinder more healthy relationships with social apps, rather than heavily dependent ones (Fang, 2019). Kim et al. (2023) support this in explaining that the relational, resource-restorative role of warm brands can more positively relate to coping strategies.

Third, despite previous work (e.g., Yu et al., 2021) and our Study 1 insights, we found no effect of agreeableness on the DVs. This can be due to the agreeable nature giving impressions of insincerity or lack of *real* listening and understanding. Accordingly, too much agreeableness can lead to ineffective perceived support and overall loneliness coping (i.e., well-being) and thus over-use and addiction.

Finally, our results show that overall relationship with AI friends is the only driver of well-being gained from using the app, confirming a body of literature supporting social attachments with social apps (e.g., Pentina et al., 2023; Skjuve et al., 2021; Ta et al., 2020). This suggests that only once a relationship is built and maintained with AI friendship apps will they influence well-being.

Taken together, these findings highlight that, while providing well-being through a sense of relationship, some AI friendship characteristics may at the same time drive an addictive usage of the apps in lonely users (see Figure 4).



**FIGURE 4** Summary of our study.

## 7.1 | Theoretical implications

This research provides several theoretical contributions. First, this paper is one of the first to examine the effects of using AI friendship apps through the lens of well-being and addiction. While previous literature examines how relationships with AI friends develop (e.g., Brandtzaeg et al., 2022; Pentina et al., 2023), our paper is among the first to highlight the implications of their use through intended positive (well-being) and unintentional negative (addiction) outcomes, thus advancing the nascent literature on the topic. In doing so, we advance previous studies on friendship and therapeutic apps (Ta et al., 2020) by offering a more granular perspective on the users and AI friends characteristics that influence users' well-being. Within this stream, we also confirm previous studies (Pentina et al., 2023; Skjuve et al., 2021) by identifying the strength of the relationship with the AI friend as the only factor increasing individuals' well-being.

Second, we add to literature on AI, well-being, and addiction (e.g., Ramadan, 2021) by identifying the factors influencing AI friendship app addiction. Specifically, this paper is the first to identify addiction as a potential outcome of the perceived sentience in AI agents. Thus, we expand literature on AI mind and humanness (e.g., Gibert & Martin, 2022; Gray & Wegner, 2012) showing that, within these contexts, the AI friend being perceived as alive can have potentially harmful consequences for users. Further, we advance previous findings on AI lack of judgments (Holthöwer & van Doorn, 2022; Pitardi et al., 2021) by showing that, in the contexts of well-being apps, this characteristic impacts the levels of addictive usage behaviors. Moreover, we contribute to wider AI literature in highlighting the role of the AI ubiquity and warmth in negatively influencing addictive behavior with the app, which contradict previous findings (e.g., Tseng et al., 2019; Yoganathan et al., 2021).

Third, we contribute to the literature investigating the link between social apps' perceived benefits and addiction (Abeele et al., 2022; Gao et al., 2017) by demonstrating that, also within the context of AI friendship apps, the perceived well-being gained from the usage influences users' addiction to it. Thus, we further expand previous studies on the use of technology as a double-edge sword for users' well-being (McLean et al., 2022).

Finally, we contribute to prior literature on social technology and social exclusion (e.g., Kayis et al., 2022; Vinuales & Thomas, 2021), showing that AI friendship apps can have detrimental effects on the well-being of lonely users. These results confirm previous literature on loneliness and social apps (Coduto et al., 2020), showing that the situational vulnerability of users strongly influences an addictive usage of AI friendship apps. At the same time, complement recent literature on the use of therapeutic apps (Ta et al., 2020) identifying users' addictive usage of the app as an additional potential outcome.

## 7.2 | Managerial implications

With the loneliness pandemic continuing to be a prevalent issue, it is expected that AI friendship apps will continue to be developed and

become more prominent features in peoples' lives. In finding AI friendship apps to have limited effects on well-being, app developers can look to develop the personalization capabilities of the apps to be able to cater to specific social needs. One suggestion would be to enhance the human-like interaction experiences through exploration of bespoke support and coping procedures. However, in finding that AI app continued usage can drive addictive usage, it is also important for app developers to ensure the apps are not over-used. As many users download separate apps to monitor and limit their in-app times, to account for cognitive escapism and addiction behaviors, AI friendship app developers should consider incorporating in-app time limits to discourage app over-use. App developers should also investigate machine-learning capabilities to recognize well-being or addiction issues and to program the AI friend to direct the user to external support platforms.

Finally, AI friendship apps such as Replika and Anima could be developed in collaboration with psychological experts such as therapist or researchers. Some existing apps such as Wysa or Woebot are web-based cognitive-behavioral therapeutic apps (CBT) and have been clinically validated by experts. Since preliminary studies showed promising results in term of users' well-being from the usage of such apps (Fitzpatrick et al., 2017), all types of AI friendships apps that offer mentorship and companionship support for potentially vulnerable users may benefit from collaborations with teams of experts.

## 7.3 | Limitations and future studies

Through a netnography and a cross-sectional study, this research offers a snapshot in time of the phenomenon investigated. Future research should examine AI friendship app usage through a longitudinal lens and explore the potential short-term versus long-term benefits and constraints of using AI friendship apps. We adopt a mixed method approach to examine AI friendship apps effects on well-being and addiction, yet, that future works may investigate alternative data collection means, such as metric data for the app usage and experiments. For instance, future research could experimentally manipulate some of the AI characteristics identified in this work and test their effect on users' well-being and addiction to identify mediating effects as well as potential boundary conditions. Further to this, several items were required to be deleted to achieve model fit, which further calls for future works to investigate supporting theories. This research was conducted using participants from the United States, due to the current adoption rate of AI friendship apps there. Given the US peculiar health support system that may encourage the use of free or low-cost applications in place of medical support, research could investigate the effects of AI friendship apps on well-being and addiction in other geographical settings to see whether our results are confirmed. As age, gender, and app type were not found to be significant controls for the model, future research may investigate other controls, such as the number of years using the app and relationship status with the AI friend. Finally, this study examined AI friendship app users who do so to cope with



loneliness. Future studies may investigate well-being and addiction effects of users who do and do not suffer from situational vulnerability such as anxiety and depression.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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