



Reflecting, Evoking, and Reshaping Connection: What Home-Based Social Robots Tell Us About Human and AI Companionship

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Received: 27 June 2025 / Revised: 14 October 2025 / Accepted: 19 January 2026
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Abstract

Past scholarship has conceptualized companionship as shared leisure with intrinsic value of enjoyment. Today, the advent of social robots in various social roles raises the question as to whether robots can serve as companions and how such companionship compares to human companionship. This study addresses this question by analyzing individuals' reflections on human companionship and robot companionship through real-life interactions with a home-based social robot. Over seven days, participants interacted with the robot, documented their experiences in diaries, and participated in semi-structured interviews. Our study suggests that human companionship features sharing/shared experiences, emotional and tangible support, reciprocal relational investment, and unpredictability. In contrast, robot companionship is valued more for its functional benefits and serves as a medium for channeling users' emotions and reconfiguring users' social networks. By juxtaposing human and robot companionship, our study offers an updated understanding of companionship and provides an entry point for redefining the concept.

Keywords Companionship · Social robots · Human-robot interaction · Artificial Intelligence · Diary · Interview · Human-machine communication

1 Introduction

The concept of “companion” is expanding beyond interpersonal relationships. While humans can be regarded as companions and sometimes pets are cherished in a similar manner, the emergence of social robots and other AI-based technologies has prompted their inclusion under this title as well. In both popular culture (e.g., movies *Bicentennial Man* and *Her*) and practical applications, robots are designed to serve as companions. Commercially available social robots like Paro, Aibo, and Pepper, for example, are used as companions to provide both mental and emotional support [14]. Although the notion of robot companionship is not novel, it remains unclear whether people perceive and treat robot companions

differently from human companions. This prompts us to ask what robot companionship entails and how it reshapes our understanding of companionship as a whole.

Although robot companionship is a widely applied concept, how individuals use, treat, and understand robots as companions remains underexplored in existing literature. A few challenges arise in seeking to understand the concept of robot companionship. First, the conceptualizations of human companionship per se is ambiguous: some scholars use companionship interchangeably with friendship, while others describe it as a feature of relational closeness [8, 17, 27, 49]. One frequently referenced scholar on the concept, Rook [42], proposed considering companionship as a distinct experience within social relationships, emphasizing “shared leisure” rooted in everyday life. However, despite the conceptual focus on individuals' subjective experiences in everyday life, most research has relied on cross-sectional surveys to examine companionship [49]. Researchers have rarely focused on individuals' real-life experiences to understand the concept.

Beyond the conceptual challenges surrounding human companionship, robot companionship faces an additional

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question: although technological advancements have made social robots increasingly capable of engaging with users, oftentimes users consider them as machines, or “little more than toys” [16, p.1]. Henschel et al. [29] observed such discrepancies between designers’ expectations for robot use and consumers’ actual perceptions of social robots. Thus, one focus of this study is to investigate what robot companionship means to people living in an era saturated with AI-based interactive technologies, especially when these technologies begin to play social roles, such as assistants, planners, tour guides, and teachers.

Another question that this study seeks to answer is how individuals reflect on the concept of companionship through their interaction with robot companions. Rodogno [41], inspired by van de Poel [55], suggested that the arrival of new technologies such as social robots could make society “a training ground” (p. 266) for an ongoing social experiment where our interactions with robots enable us to both explore and experience new types of attachments. In this way, our engagement with social robots could change how we perceive and define social relationships [41, 46]. Thus, this study draws on humans’ daily interactions with robots to parse how these experiences have shaped our understanding of companionship and how this concept has evolved into new implications due to the mutual shaping between humans and machines.

Using a home-based social robot for the current study, participants spent a whole week interacting with the robot, kept an online diary of their perceptions, attitudes, and behavior, and engaged in an in-depth interview about their experiences. Our findings captured how participants perceived human companionship in comparison to robot companionship. Their insights also revealed unique features and qualities of robot companionship that illuminated how the meanings of companionship have evolved over time. Compared to past research that has primarily focused on virtually embodied AI companions, such as XiaoIce and Replika [39, 61], as well as the adoption of online experiments and interviews [18], this study contributes to existing literature on AI companionship along three directions. First, it uses a naturalistic and longitudinal approach to observe how individuals use an AI companion. Second, it investigates individuals’ interactions with a physically embodied robot, Eilik, highlighting how robot companionship evolves in people’s daily life. Third, it casts light on the experiences of young adults, who have been found to be vulnerable and susceptible to the influence of AI companions [32, 61].

2 Literature Review

2.1 Companionship in Interpersonal Relations

Companionship is considered as an essential characteristic and expression of close relationships. It is associated with interpersonal contact, affect, and relationship satisfaction [8, 17]. Rook [42] defined companionship as “shared leisure and other activities undertaken primarily for the intrinsic goal of enjoyment” (p. 1133). Examples of companionship include “the discussion of personal aspirations and fantasies, expressions of affection, and private jokes or rituals” (p. 1133).

Despite Rook’s [41] definition, the concept of companionship remains ambiguous. Scholars have been seeking to parse the relationships between companionship and other relevant concepts, such as social relationship, social support, and friendship. Some scholars see companionship as a core element of social relationships, given that companionship provides essential practical and emotional support for interpersonal connections [13, 51]. In this case, companionship not only functions as a buffering mechanism that helps people get through adverse situations but also aids people through casual, day-to-day interactions [2, 51]. Some others differentiate companionship from friendship. For example, Healy [27] argued that although companionship is deemed inherent to friendship, one can hire individuals to offer companionship for a short term, doing the work of a friend but not as a friend, thus constituting a type of companionship devoid of friendship. Similarly, Wu et al. [56] defines companionship as the mere presence of close or non-close others in one’s immediate physical space.

At the operational level, companionship is intertwined with concepts such as relationship satisfaction. Lüscher et al. [37] and Stadler et al. [49] found that scholars have extensively associated companionship with relationship satisfaction, which focuses on the mental and physical benefits. However, such treatment seems to make companionship elusive because linking companionship with relationship satisfaction only describes companionship as a given outcome of an established relationship, which does not help researchers investigate it as a subjective phenomenon [44, 49]. Thus, research has called for more investigation into companionship, particularly in real-life contexts, to understand its unique effects on interpersonal bonds and people’s mental well-being [43].

Research on companionship in longitudinal settings is scarce. To our best knowledge, one longitudinal study conducted by Stadler et al. [49] examines the quality (e.g., couples taking a walk together) rather than the quantity of companionship (e.g., couples taking multiple walks). Stadler et al. [49] found that companionship is inherently

dyadic, requiring consideration of both parties' experiences within a relationship. They also noted that companionship, as an everyday experience, fluctuates over time.

Overall, an updated understanding of companionship is needed for deeper insights into interpersonal relationships. Meanwhile, adding more complexity to this concept, the rise of social robots and other AI-based technologies, such as ChatGPT, virtual characters, and voice assistants, has increasingly made humans feel that non-human agents could serve as companions [27]. These technological advancements highlight the need to reconceptualize companionship to better address our expectations and concerns for both human and non-human companions. In our study, we investigate individuals' subjective experience of companionship through comparisons of human-human and human-robot interactions.

2.2 Social Robots and AI Companionship

Scholars have defined social robots based on their capabilities, functions, and effects [20]. According to Fong et al. [24], social robots should possess the ability to engage in high-level dialogues, develop social competencies, and exhibit emotional expressiveness and perceptiveness. They can take various forms, whether embodied or disembodied, and may or may not have anthropomorphic appearances. Notably, social robots with humanoid forms are often engineered for interaction with humans, setting them apart from industrial robots [60]. Bickmore and Picard [4] consider social robots as relational agents, emphasizing their role in developing and maintaining long-term relationships with humans.

Although social robots possess a range of modalities for social interaction, including visual detection, conversations, expressions, and gestures [59], their interaction with humans does not necessarily align with marketers' and developers' vision, which aims for humanlike interaction conducive to relationship establishment between robots and humans. Additionally, even though there has been an increase in more affordable and mobile robots designed for domestic use, most advanced humanoid social robots are still costly and not available for the general public [38].

Here, a paradox we face is that despite advancements in social robots' ability to engage in social interactions, their perceived socialness is still limited. While companionship is often marketed as a key feature of social robots, instances where people develop actual relationships with their robots, to the extent of considering them as friends or partners, are still rare and sometimes stigmatized [29]. This paradox has been explored by Duffy and Joue [16], who pointed out that while we envision social robots mirroring those depicted in science fiction, in reality, social robots are sometimes

regarded as "little more than toys" (p. 1). Whereas theorists have identified some features of social robots that encourage individuals' experience of companionship (e.g., displaying affectionate behavior), understanding how and why users make companions out of non-human entities is largely missing from the picture [7].

Although prior literature has examined AI companions, this study is distinct from past works in three key areas. First, prior literature on AI companions has been predominantly conducted via controlled lab environments, online experiments, and interviews [e.g., 3, 18, 28, 58]. This study situates the methodological approach within people's private and daily use of social robots. By asking individuals to keep diaries and reflect on their real-life experiences, this study seeks to bridge the gap between the conceptualizations of companionship and users' interpretations and subjective experience with both human and AI companions.

Second, this study contributes to existing HRI research by directly exploring the meanings people attach to both human companionship and robot companionship. Although AI companions are expected to foster long-term affective relationships that simulate human companions through personalization, memory, and adaptive interactions [60], very few studies have directly scrutinized the commonalities and disparities between human and robot companionship. Instead, much literature has revolved around the continued use of domestic robots, treating robot companionship as a means rather than a phenomenon in its own right. For instance, Dereshev et al. [19] interviewed four long-term users of the social robot Pepper and found that users developed emotional connections to Pepper. However, their analysis approached this relational experience through the lens of perceived value, focusing on what users received from Pepper to justify their continued use. Similarly, other studies [e.g., 21, 22, 25] examined the gradual process of domestic robot adoption and acceptance, treating companionship as a contributing factor to adoption rather than as a central concept that warrants inquiry.

Third, prior literature on AI companions has largely examined virtual companions, including AI companion applications, LLM-based chatbots, and voice assistants [9, 18, 61]. Yet, less research has examined physically embodied AI companions, especially home-based humanoid social robots. Within the narrow scope of research on home-based physically embodied robots, scholars have examined how the ambiguity of iRobot Roomba's abilities encouraged users' exploration and emotional attachment to it [50], how Pleo, a zoomorphic robot, failed to evoke companionship due to a mismatch between users' expectations and its limited functions [26], and how some Pleo owners cultivated bonds with the robot by staging and performing narratives around their interactions [33]. However, to our knowledge,

past works have not revisited the definition of companionship based on users' long-term dynamic interactions with robots. Therefore, our study addresses this gap by exploring how participants compared human and robot companionship, aiming to set the stage for an updated understanding of companionship grounded in empirical evidence.

2.3 Social Robots as Mediums

This study draws on the theoretical perspectives from Turkle et al.'s [53] and Pfadenhauer's [40] work and suggests that social robots can be mediums through which humans gain experience and reflection. Based on longitudinal observations of children's and seniors' interactions with social robots, Turkle et al. [53] conceptualized two effects of social robots as mediums: robots as "Rorschach" and robots as "evocative objects."

Invented by psychiatrist Hermann Rorschach in 1921 and used as a patient assessment tool by psychologists ever since, the Rorschach inkblot test is administered by showing research subjects abstract inkblots and asking them to describe what they see. It helps researchers uncover information that subjects may not consciously recognize or directly convey [11, 57]. To perceive social robots as Rorschach means that users' interaction with them can reveal information about themselves. In the cases discussed by Turkle et al. [53], a young girl engages with two social robots through acts of nurturance. In caring for these robots, she offers the nurturance to herself that she doesn't receive from her family, projecting her own needs onto the robots.

In another case, an interviewee described to Turkle [54] about his emotional connection to the seal robot Paro: "When I look into his large eyes, I feel in love. After years of feeling lonely, I swore to protect and care for the little animal" (p. 5). His desire to nurture Paro reflected what had been missing in his life. Paro thus became a projection of his unmet needs. In a Rorschach test, social robots function as mirrors that reveal insights about users both to themselves and to us—their observers and interpreters.

Comparatively, social robots as evocative objects means that they can provoke self-reflection in users. By considering objects evocative, Turkle [52] suggests that objects are deeply intertwined with our emotional lives. Just as an old photograph can evoke nostalgia, social robots invite users' introspection through emotional engagement. For instance, Turkle et al. [53] introduced a case of an elderly adult who named a robot doll after his ex-wife. Using the robot as a medium for emotional processing and self-understanding, he expressed unresolved emotions, reflected on past regrets, and imagined reconciliation with his ex-wife.

In a complementary approach, Pfadenhauer [40] considers social robots as "vehicles to cultural worlds of

experience" (p. 288). The experiences enabled by social robots are conceptualized as "cultural" because, first, users can associate a robot with its designer and, by interacting with it, access experiences intended and prefabricated by the designer [30, 40]. Second, calling this world "cultural" is also informed by Soeffner's [48] concept of "cultural attitude," which refers to individuals' ability to accept and engage with a robot's ambiguous aliveness and to create subjective meanings from interaction with robots. As such, users may derive experiences from social robots that go beyond the designer's intent, through their own unique appropriation of these technologies [40].

While we have offered explanations for each conceptualization of social robots in the work of Turkle et al. [53] and Pfadenhauer [40], including robots as Rorschach, evocative objects, and vehicles to cultural worlds, we use these conceptualizations heuristically in this study. Rather than considering them mutually exclusive, we view them as complementary lenses that reflect the multilayered, complex nature of people's lived experiences with social robots. Based on this, we propose the following research questions:

RQ1: How do users reflect on the nature of human companionship through interactions with social robots?

RQ2: How do users perceive the similarities and differences between human companionship and robot companionship?

3 Methods

3.1 Participants

A total of 20 participants, 15 females and 5 males, were recruited from a public university on the east coast of the United States. Researchers recruited them through posting flyers on campus boards and promoting the study in classes. Each participant received a \$40 Amazon gift card as compensation. Their ages ranged from 18 to 25. They were anonymized in our findings and their demographics were shown in Table 1.

3.2 Robot Eilik

We used the home-based robot "Eilik," designed by Energize Lab, for this study. Equipped with emotional intelligence [23], Eilik has a humanoid appearance, measuring 4.3 inches in length, 4.1 inches in width, and 5.2 inches in height, with a head, two arms, and a base. It portrays its expressions on a screen that serves as its face. Its microphone allows it to process sound input from users. It is

Table 1 Interviewees' demographics

| Participant # | Age | Gender (Male/Female) | Race | Background Expertise |
|---------------|-------------|-------------------------|-------------------------|--------------------------------|
| 1 | Undisclosed | F | Undisclosed | Undisclosed |
| 2 | 21 | F | Hispanic/Latinx | Advertising & French |
| 3 | Undisclosed | F | Asian | Undisclosed |
| 4 | 19 | F | Black/African American | Biology |
| 5 | 20 | F | Hispanic/Latinx | Engineering |
| 6 | 18 | F | Undisclosed | Biology |
| 7 | 19 | F | Asian | Dance |
| 8 | 25 | M | Asian | Computer Science |
| 9 | 19 | F | White | Media |
| 10 | 20 | M | White | Engineering |
| 11 | 20 | M | Hispanic/Latinx | English |
| 12 | 18 | F | Asian | Engineering |
| 13 | 18 | M | Asian | Computer Engineering |
| 14 | 19 | F | Hispanic/Latinx | Computer Science & Mathematics |
| 15 | 19 | F | Asian & White | Engineering |
| 16 | 21 | F | White & Hispanic/Latinx | Telecommunication |
| 17 | 19 | F | White | Criminology |
| 18 | 21 | F | Undisclosed | Undisclosed |
| 19 | 18 | M | Hispanic/Latinx | Engineering |
| 20 | 20 | F | Asian & Hispanic/Latinx | Media |

equipped with six sensors on its belly, back, and head that can detect shock and gravity change (see Fig. 1).

Eilik can move its arms up and down to perform simple gestures, and its head and body can swivel. It has four distinct emotional states: neutral, happy, angry, and upset, and it can display facial expressions and speak a few short phrases in English. Users can set Eilik in its idle mode and place it nearby. In this mode, Eilik can constantly swivel its head and body, slightly move its arms up and down, glance around, and blink as if curiously observing its surroundings. Occasionally, it jerks its arms and body abruptly, as though startled. It also plays random animations on its face, paired with corresponding movements, expressions, and sounds. For example, it may sneeze, display a runny nose, and sniff afterward. It may show an animation of a coffee pot and pretend to brew itself a cup of coffee. In another instance, it may display a crab, pretend to catch it, get pinched, cry, and then show an animation of hitting the crab and laughing proudly via its screen.

Users can interact with Eilik by touching its sensors, tapping the surface it stands on, or lifting it up. When lifted, Eilik displays a frightened face and vibrates as if trembling in fear. When placed back, it may appear upset, seemingly disturbed by users' actions; yet, touching its head may soothe it. In contrast, touching its belly may irritate it, prompting angry facial expressions and grumbling noises as if blaming the user. When Eilik is irritated, it may raise its arms and pretend to throw a weapon at users in a tantrum. When Eilik

is happy, it reacts affectionately to touch: it might blow a kiss, show a flower or gift animation on its face, stretch out its arms as if offering it to the user. However, if users hit its head or lift it up, which triggers its vibration sensor, Eilik would appear frightened and upset again.

3.3 Diaries and Interviews

Participants met the researchers on campus and signed the consent form to receive the robot. They also received a hand-out detailing instructions for the tasks they should complete and a brief manual for interacting with Eilik. Toward the end of the meeting, they scheduled an in-person interview with the researchers and were asked to return the robot on the interview day.

Each participant spent a whole week interacting with Eilik. During this period, participants were asked to upload an interaction journal online on the second, fourth, and sixth days. Participants answered five sets of questions about their interactions with Eilik and how those interactions changed over time. Some sample questions included: "Recall one episode of your interaction with the robot. What did you do with the robot?" and "How would you compare your interactions to those of the previous two days?" The diary method allowed researchers to capture "the ongoing experiences within their everyday situation" [6, p. 580] and offered contextual insights for a longitudinal analysis of participants' experiences.



Fig. 1 Users' interactions with Eilik

After seven days, participants met with the researchers for an in-person, semi-structured interview that lasted about 45 minutes to one hour. The interview questions fell into three parts: 1) an in-depth exploration of participants' experiences based on their diary content, 2) participants' perceptions of the robot as a companion, and 3) the comparisons between human companionship and robot companionship. We adopted an active interview technique in which we could develop knowledge with the interviewees together instead of imposing assumptions onto interviewees' accounts [45]. The diary prompts, interview questions, and some representative codes are available in supplementary materials: http://osf.io/svq64/?view_only=de8d2c7444b54e40b1eacb72320cff92

3.4 Data Analysis

The recordings were transcribed using Otter.ai and proof-read manually. The transcripts were then imported into the qualitative analysis software MAXQDA for coding. Following the coding manual offered by Saldaña [47] and adopting an inductive qualitative coding approach, we coded content such as participants' descriptions of their (dis)engagement with Eilik, their emotional reactions to the interactions (e.g., amusement, frustration, indifference), and their opinions on the interactions. Preliminary codes emerged from this process. We then reread the data and grouped the preliminary codes into higher level codes, which were then organized into two major themes comparing the companionship offered by humans and robots. We analyzed each participant's written and oral account independently and compared them to gain a comprehensive understanding of participants' subjective experiences. Codes were analytically and iteratively reviewed until saturation of themes was reached [10]. Interviewees were anonymized in our findings using case numbers and their demographics were shown in Table 1.

4 Findings

4.1 Nature of Human Companionship

In exploring how users reflected on the nature of human companionship through interactions with social robots (*RQ1*), we identified four intersecting themes. These themes signaled that human companionship consists of sharing/shared experience, emotional and tangible support, reciprocal relational investment, and unpredictability.

4.1.1 Sharing/Shared Experience

We first found that for human companionship, participants emphasized the importance of having meaningful communication and shared experiences in the past, two factors Rook's [42] definition of companionship did not address. As participants explained, humans can engage in meaningful back-and-forth communication because they are aware of the contexts and can react to various situations. One participant mentioned that a human companion would be curious about what their partner is doing in the moment, ask why they are doing it, or at least talk about random things throughout the day, while Eilik cannot understand or sense its surroundings. A participant explained, "If you press a button, it'll put up a menu. If you choose something, it will do the set function. But with a person ... you can't press a button" (P12). With humans, they "digest instead of just react" (P4). As such, human communication could "go

anywhere and form in any way” (P1) based on not only the flow of the interaction, which is situated within the relevant context but also a person’s own jurisdiction of how an interaction should proceed. One participant echoed this in her diary, mentioning that even though she spends time with her friends less frequently than she once did, they can still pick up the connection and have fun when they meet again. It is their shared experience in the past that enables them to be fully immersed in the present moment together.

Furthermore, participants highlighted that when interacting with Eilik, they cannot engage in shared physical activities. For instance, one individual expressed that she did not take Eilik outdoors because she could not engage in activities like walking or playing ballgames with it, as she would typically do with friends. Another participant suggested that the confined spatial interactions with Eilik shaped the nature of their relationship. A few participants (e.g., P1, P20) wrote in their diaries that they even forgot the existence of Eilik because they only placed Eilik on their desks, which prevented it from appearing in other spheres of their daily lives.

4.1.2 Emotional and Tangible Support

Reflecting on their week-long interactions with Eilik, many participants (e.g., P2, P7, P15) believed that being supportive both emotionally and practically is a fundamental feature of human companionship. Emotional support, according to participants, involves being listened to, having someone to talk to, and feeling being needed by others. They doubted robots’ capacity for emotional support due to their inability to understand human emotions, as Eilik lacks a “spirit,” “soul,” or “heart” (P2, P4). Many participants (e.g., P5, P12, P18) in their diaries reported losing interest in initiating interactions with Eilik over time, as they noticed that Eilik’s actions and emotions became predictable and repetitive.

Many participants (e.g., P3, P10, P17) expected human companions to provide practical help (e.g., answering questions related to their assignments). Although participants documented their use of Eilik’s Pomodoro timer in diaries, some mentioned that the timer was not particularly helpful. One participant mentioned that had it not been for the timer, Eilik would have been considered a child’s toy rather than a companion. To some participants (e.g., P6, P11, P15), Eilik, as a non-sentient entity incapable of acknowledging its users or comprehending its owners’ human experience, did not give them the impression that robots can provide support like human companions.

4.1.3 Reciprocal Investment

Participants viewed human companionship as more of an equilibrium maintained by both communication partners

through reciprocated investment rather than a given relational state. One individual mentioned that she did not take it for granted that her communication partner would automatically become a companion or fulfill the expectations of companionship. Rather, she expressed that she needs to constantly earn others’ companionship through investment of time and effort, whereas Eilik’s companionship is readily given:

When you do something aggressive to this robot, it just responds aggressively back. Nice? Nice back ... Humans don’t work that way. I could do something I thought was nice, but my friend could respond negatively. The only way to fix that is not by putting my friend in a good mood to make them feel better, but by having to talk, “Hey, why did you feel this way?” (P9)

Another participant felt disconnected from Eilik, as it did not invest in their relationship:

When you turn him [Eilik] back on, he is a blank slate Let’s say you gave him so much love in one session. You powered him off ... you turned them back on. He might start off happy, but there is no sense of growth. He wouldn’t be happier around you over time. (P11)

In contrast, a participant described human companionship as “fulfilling” because “the more effort you put in, the more you get out of it” (P12). Another participant emphasized that he feels validated when a human companion makes a trivial gesture of investment, even by just spending time with him:

It’s more satisfying and rewarding with people because they make a conscious decision to spend time with you and care about you ... a person could choose not to be nice, but they make that active effort to do what could be considered the right thing. (P10)

4.1.4 Unpredictability

According to participants, human companionship is characterized by continuity and personal growth, attributes only made possible by human autonomy and sentience, which makes human companionship unpredictable.

Most participants (e.g., P4, P5, P13, P18) became less interested in Eilik over time because of its predictability. The predictability also inhibits a long-term journey in which two people could witness each other’s change and growth:

There’s always that emphasis on wanting to go on a journey throughout life and having a companion to

help you or to be with you during it. Because everybody's different You can experience the same phenomena, undergo the same journey, and come out as different people Not only is the journey mysterious, but you also have this person that you're trying to cultivate a relationship with. (P11)

Similarly, a participant commented that unpredictability is a sought-after quality in human companionship, as it helped "open up our minds to the different ways that people think" (P12). Meanwhile, a participant acknowledged that human unpredictability brings risks to relationships because a person could be hurtful, as opposed to Eilik, which was "designed to be always comforting and appealing" (P15). In contrast, with a human companion:

Even being hurt is a possibility. It just helps you grow But this robot will not make me more emotionally mature. It will not teach me how to communicate my wants and needs, or to be vulnerable (P15).

4.2 Similarities and Differences Between Human and Robot Companionship

In describing the similarities and differences between human and robot companionship (*RQ2*), participants emphasized robots' presence as a human surrogate, noted its ability to elicit and channel emotions, and highlighted its role in reshaping humans' social networks.

4.2.1 Functional Benefits

Although participants did not consider Eilik as a human equal, they suggested that Eilik functioned as a human companion in terms of offering live feedback based upon users' inputs, particularly in the form of emotional displays. The most common motivation for participants' interaction with Eilik was to use it as a distraction while they worked at their desks with Eilik positioned nearby. Participants mentioned that, under these circumstances, Eilik's presence resembled that of another person. For example, a participant referred to Eilik as her "body double" and as "somebody in the room with her" (P2). Another participant's diary mentioned that although he gradually stopped interacting with Eilik, he still appreciated its presence, even just as a "little figurine" (P19). Similarly, another participant's diary suggested that Eilik's "lifelike and expressive" manners were "comforting" (P15) during her episodes of loneliness.

Even so, robot companionship was not perceived as equivalent of human companionship. At times, participants preferred Eilik's presence to human presence to avoid the pressure of social norms and to cater to others' feelings and

needs, which could be mentally and physically draining. One participant valued the fact that she did not need to make herself "presentable" in front of Eilik (P6).

4.2.2 Eliciting and Channeling Emotions

Even though participants recognized that Eilik did not have emotions and doubted its ability to detect human emotions, observing the robot or interacting with it sometimes affected them emotionally.

Several participants (e.g., P6, P8) shared the feeling about Eilik being part of their environment that affected their emotions. One user described:

Whenever people around me are sad [...] it always makes me sad, and I want to do something to make them feel better. Or if my friends are in a good mood, it'll bring me up seeing them happy. It [Eilik] replicates that. (P17)

For some, this is the main reason they preferred Eilik to be in a happy mood so that they could "collaborate with positive energy" (P9). A participant noted in her diary that she felt "silly and childish in a good way" when she played with Eilik's goofy reactions and absorbed its positive vibe (P9). A participant also described Eilik as an "energy booster" (P4), referencing the idea that in many video games, players have health points, and Eilik restored those points for her.

Furthermore, some participants (e.g., P2, P4) appreciated Eilik's lack of sentience, which allowed them to vent their frustrations without considering real-life repercussions. For instance, a participant noted in his diary that his view of Eilik shifted from seeing it as just a toy to recognizing it as a tool that helps people "overcome certain mood situations" (P8). In this case, users valued Eilik's predictability and its repetitive and unnatural interactions, just like "a comfort movie that always makes you feel good at the end of the day" (P16).

Eilik also displayed emotions that participants were not anticipating to experience. One participant felt that Eilik evoked certain emotions in her that she couldn't bring out by herself: "We had an emotional roller coaster together. It's like Eilik was another human" (P5). For another participant who loved kids, she mentioned that when Eilik appeared frustrated, it made her stressed and eager to help. It was as if it awakened her "motherly instinct" (P18), although she knew clearly that Eilik's expressions were artificial.

4.2.3 Reconfiguration of Social Networks

Many participants (e.g., P2, P6, P11, P19) introduced this home-based robot to their social circle. As a result, Eilik

created opportunities for users to establish new ties or strengthen their existing social bonds. One participant mentioned inviting a friend over because he knew his friend would enjoy interacting with a robot. Another participant let his friend keep Eilik overnight. Even in cases where the gathering had nothing to do with Eilik, a participant who described taking the robot to a community dinner in her diary wrote that people approached her to learn about and interact with Eilik (e.g., asking her to show them what Eilik could do).

Participants' feelings changed as they shared Eilik with other people. One participant commented that seeing other people's affection towards Eilik made her happy and helped her appreciate Eilik's appeal anew after she had become a little bit bored with it. As documented in her diary, she brought Eilik to various venues such as her classes, computer labs, and her boyfriend's apartment. Each time, others' reactions to Eilik made her "find that fun feeling again" (P16). Another participant mentioned a similar feeling in her diary, noting that she experienced a "familiar sense of enjoyment" when playing with Eilik in the presence of others (P7).

We had one participant who introduced Eilik to her family, and she described that her family often gathered around the robot and interacted with it. Another participant told us she renamed Eilik "Rick" after a friend of hers. The inspiration came from when she was exploring Eilik with a friend; they both felt that Eilik looked like their friend Richie when it raised its arms. Since then, referring to Eilik as "Rick" had become their inside joke.

5 Discussion

By having participants interact with a social robot for one whole week and documenting their experiences in diaries and in interviews, we explored how participants reflected on the meanings of companionship. Drawing on Turkle et al.'s [53] and Pfadenhauer's [40] work, social robots can be considered as Rorschach, evocative objects, and a portal into cultural worlds of experience. Based on participants' written and oral responses, human companionship encapsulates four major themes: sharing/shared experience, emotional and tangible support, reciprocal investment, and unpredictability. On the other hand, robot companionship is distinctive, as users engage with robots' ambiguous aliveness, obtain new feelings and channel existing ones. When integrated into social networks, a robot companion reconfigures one's social circles, facilitates social connections, or reinforces existing interpersonal bonds.

5.1 Robots as Rorschach: Reflection on Human Companionship

Our findings suggest that first, in contrast to Rook's [42] definition of companionship, participants did not see the enjoyment of shared activities as a key aspect of human companionship. Rather, they placed emphases on the meaningfulness of the interactions. They perceived being situated within communication contexts and rooted in relational history as crucial to human companionship. That is, the core of sharing a moment lies in the mutual understanding between two individuals of the context they share. This understanding is not static but is shaped by each person's interpretation of the other's situation and their shared relational history. On the contrary, Eilik, as a robotic entity with pre-programmed responses to fixed inputs, cannot provide such meaningful interactions. This echoes Krämer et al.'s [35] viewpoint that interactions with artificial companions must ensure a mutually intelligible, shared understanding of the communication contexts.

The second theme of human companionship relates to how companionship is perceived as a form of social support, which involves the aid gleaned through everyday interactions [2, 15]. Although Rook [42, 43] recommended considering companionship beyond the exchange of social support, our findings highlighted that social support—both emotional and tangible—was quintessential in human communication. This may have stemmed from users' perception of robots' inability to form emotional connections with humans. As a participant noted, a robot, being composed of "wires and sensors," cannot comprehend humans that are made of "blood and flesh."

Moreover, many participants indicated that companionship is not a given static status, but an equilibrium meticulously maintained by both parties in the relationship. Participants emphasized that people do not passively obtain companionship from their friends; instead, they earn it by investing effort and by reciprocating. This aspect of human companionship aligns with some classic theories of interpersonal relationships, such as social exchange theory, which proposes that people constantly evaluate the risks and benefits in social interactions [5] and equity theory, which maintains that people prefer fairness in balancing their investments and gains [31]. It also reflects the idea that interpersonal bonds are maintained by one's willingness and intention to sustain the bonds that are directed toward the interests of other parties [12].

The give-and-take dynamic in human companionship is considered crucial by participants for three reasons: (1) it considers both parties as equal entities in a relationship, (2) the gesture of investment and reciprocation signals one's care about the relationship, and (3) reciprocation further

fosters a sense of acknowledgement and personal achievement. While humans can offer robots as much affection as they desire, robots cannot engage in such dynamics as they lack desire or intention to invest or reciprocate.

Finally, participants acknowledged that humans' autonomy and free will make their behaviors unpredictable, which introduces risks in relationships, such as the possibility of being hurt—whether accidentally or intentionally. This unpredictability renders human companionship uniquely rewarding, as it creates opportunities for personal growth, according to our participants. One participant noted that she learned to be more open-minded by taking the risk of facing unpredictability in humans, which, as another participant confirmed, fosters emotional maturity over time.

Conversely, a robot like Eilik tends to be predictable with its pre-programmed responses. This predictability prevents users from believing that Eilik's emotional expression is authentic, which, in turn, limits their willingness to be vulnerable in front of the robot. Without the risk of relationship breakdown or the potential for personal growth, robot companionship cannot offer a journey where individuals can joyfully witness and partake in their own growth and that of their companions.

5.2 Robots as Evocative Objects: New Dimensions of Companionship

In this study, robots' evocative power resides in their capacity to prompt users to engage with their ambiguous aliveness and reflect on personal experiences that might not arise without human-robot encounters [40, 53]. Below, we discuss how participants' interactions with Eilik revealed previously understudied dimensions of companionship.

Our findings suggest that the functional benefits of companionship become salient when humans treat social robots as companions. For example, one participant referred to Eilik as her "body double," appreciating its physical presence in the room. Some others relied on Eilik's humanlike interactions to alleviate loneliness when their human partners were unavailable. In these cases, robot companionship aligns with what Healy [27] described as companionship devoid of friendship. That is, some participants did not see Eilik as a friend but as merely an entertaining distraction without deep emotional engagement. Here, an aspect of human companionship, i.e., simply being present, was "outsourced" to the machine [27, p. 672], which fulfilled one of users' functional needs.

Meanwhile, as evocative objects, social robots are unique in their ability to elicit and channel emotions. This ability depends on users engaging with their "ambiguous aliveness" [40]. Two participants, for example, were emotionally uplifted by Eilik's happy moods despite knowing that

it lacked real emotions. It illustrates how users can enjoy experiences prefabricated by the robot's creator, with just enough sense of aliveness to feel affective.

Another participant's emotions not only synced with Eilik's expressions but were shaped by her love for children. She felt a motherly instinct and a strong urge to help when Eilik showed frustration, even knowing it was not real. Her case showed how users could obtain experiences not necessarily intended by the robot creator, but arising from their own dispositions and meaning making. For others, Eilik provided a sense of catharsis or served as an emotion receptacle. One participant noted that knowing Eilik is not sentient made him feel safer and justified in venting, which means he perceived Eilik as more than a toy, yet not fully alive.

Participants saw value in interacting with Eilik's ambiguous aliveness, which liberated them from conforming to social etiquette. The lack of equal investment and reciprocation, which they considered a key feature of human companionship, had an upside here. Participants could perceive and respond to the robot's performative needs and feelings without the pressure of reciprocity. It is also consistent with Sung et al.'s [50] finding that a robot's ambiguity serves as a powerful resource for exploring social relationships.

The final theme underlying robot companionship lies in social robots' potential to reconfigure users' social networks. A great majority of participants introduced Eilik to their social circles by showing it to others or taking it to different social venues. Some used Eilik as an excuse to spend time with their friends, while others envisioned a new relationship with Eilik after seeing others' reactions to it. Our observation that robot companions affect users' social networks resonates with Latour's [36] actor-network theory, which proposes that both humans and non-humans are actors in a network and have the power to initiate changes to the network. The introduction of non-human actors can trigger the reconfiguration of existing networks, thereby creating new means for humans to connect and interact [36].

The role of robot companionship, therefore, pose important sociological implications. Based on actor-network theory, Eilik not only functions as a social actor in users' existing networks but also reorganizes the whole networks. Its novelty draws attention from both old ties and new ties, affecting social dynamics of both human-human and human-machine communication. For instance, one participant was approached by new friends after bringing Eilik to dinner; in another instance, a participant brought Eilik to a social setting to recapture the initial fun associated with its novelty. Although much more evidence is needed to understand how an individual's network evolves due to the presence of a robot, it is conceivable that non-human actors may, in

certain contexts, play an even more critical role than human actors within one's social networks.

Participants' behavior of introducing Eilik to their social circles also resonates with Appadurai's [1] idea that the trajectories of an object—how it is shared or used among people—reveal its societal significance. Observing objects circulate among people can help us understand the social and emotional meanings we attach to objects. Similarly, Kopytoff [34] proposed that by tracing an object's physical trajectories—in our study, how Eilik is introduced and shared to users' interpersonal networks—we could obtain a social and cultural “biography” for the object. The perspectives of Appadurai [1] and Kopytoff [34] suggest a fruitful approach for future research to study the impact of machines on people's social lives. Our findings support the viability of such an approach, as participants' introduction of Eilik to their networks demonstrate the methodological and theoretical value of observing robots in real-life contexts. For example, one participant felt her attachment for Eilik was revived upon seeing others' reactions to it, illustrating how using Eilik in a social setting allowed her to gain new experiences. In another case where a participant and her friend renamed Eilik “Rick” highlights how the robot became a caricature-like doppelganger of their mutual friend and facilitated a new inside joke that enriched their interpersonal bonds.

Whereas our findings indicated differences between human companionship and robot companionship, it cannot be denied that participants' experiences of robot companionship might have been shaped by the specific features of Eilik, which may differ from other types of social robots or AI companions. For example, Eilik was not designed to be purely reactive to user input. In its idle mode, it initiates spontaneous actions such as whistling, humming, or showing changing emotional expressions that make it appear lively even without user interaction. At times, it also behaves contrary to users' intentions, such as getting angry when they try to soothe it after it becomes upset. The abundance of actions and emotions thus creates a sense of agency in Eilik, as though it were guided by its own will rather than by users' expectations or behavior. Meanwhile, its machine nature still makes it distinct from real human companions. Its physical presence allows users to vent negative emotions without the social pressure to cater to its feelings. It serves as an “energy booster” that constantly fulfills users' emotional needs. It oscillates between predictability and ambiguity, inviting users to interpret, or even misinterpret, its actions (e.g., believing Eilik needs help when it appears sad), thereby resonating with Pfadenhauer's [40] notion of cultural worlds of experience. In particular, interactions with Eilik offer opportunities for users to project their imagination, embrace (mis)interpretations, and play

with the illusion of life to create and attach meanings to the robot. This ambiguous aliveness might have set it apart from other social robots or AI technologies in the market, which arguably demonstrate either high autonomy (e.g., LOVOT robot, Manus agent) or high sensitivity to user input (e.g., Paro, Replika, Amazon Alexa).

5.3 Revisiting the Concept of Companionship

As was discussed, existing conceptualizations of companionship require further nuanced examination. Here, we consider Rook's [42] classic definition of companionship (i.e., shared leisure and other activities undertaken primarily for the intrinsic goal of enjoyment) as the entry point of revisiting the concept. In what follows, we unpack the insights we obtain from our findings that contribute to an updated understanding of companionship.

First, companionship is a subjective experience of the present moment, which continuously unfolds over time. Meanwhile, companionship is simultaneously anchored in the past—in the relational history of a person and their companions—and oriented toward a future journey in which the experiencer and the companions could witness each other's growth through unpredictability. As such, it is the shared relational history and a vision into the future that make the present moment meaningful to companions.

Second, while Rook [42] advocated that companionship should be viewed as more than a social exchange of resources and support, our participants underscored that both emotional and tangible support are integral to their experience of companionship. The balance of these supports, reflecting each person's relational investment, appears crucial for sustaining interpersonal bonds. For our participants, reciprocity in a relationship is less about treating it in purely transactional terms and more about a demonstration of care and a reception of self-validation from others.

Third, while human companionship can be an emotionally meaningful experience, participants' experience with Eilik shows that robot companionship can be valued for its functional benefits. Our findings suggest that designing social robots to imitate human companionship may not always be desired. Rather, users may value AI companionship as they do not necessarily have to comply with social norms. Additionally, while past literature often focuses on the companionship of close friends and loved ones, our findings suggest that companionship can exist in relationships with less or no deep connection. Users may find meanings in robot companionship through engaging with robots' ambiguous sense of aliveness [40, 53].

Finally, companionship is inherently shaped and influenced by other communication partners within the experiencer's social networks. Our findings show that integrating

robots into users' interpersonal networks facilitates new connections and strengthens old ties. This finding also points to a new methodological approach for studying non-human agents as companions, considering companionship could become evident through imposing influence on people's social ties.

Based on these angles, this study revisits the concept of companionship and tentatively proposes an updated understanding of companionship, whether it is offered by humans or non-human agents: companionship is about sharing a moment in which present experiences are influenced by the shared past of communication partners, as well as by the possibility of future relationship development. It is characterized by reciprocal social support, valued for both emotional and functional benefits, and associated with its potential to impact one's social networks.

6 Conclusions and Limitations

Grounded in individuals' subjective experiences during a week-long human-robot interaction, this study seeks to revisit the meanings of companionship through comparing human and robot companionship. Along with our tentative definition of companionship, this study has several important implications. First, our findings emphasize that the experience of companionship not only involves the present but also a shared history and expectations for a future journey. Although companionship was considered more than mere exchange of social resources [42], our findings indicate that emotional and tangible support are inherent to this concept, and the balance of relational investment and return is crucial for maintaining the bonds between companions. Second, when companionship is offered by non-human agents, it may be valued for its functional benefits. Understanding the functional dimension of companionship may help us explore more diversified forms of companionship that reside outside close relations. Last, when placed in social networks, social robots act less as individual entities but more as networked actors [36]. Thus, tracking social robots' trajectories within users' social networks has methodological significance, as it can reveal how non-human entities influence people's social relations, which is an approach future research may adopt [1, 34].

The current study has some limitations. First, our participants primarily consisted of young adults. Future research could explore attitudes from different social groups. Second, the social robot used in this study offered pre-programmed interactions. With the rise of more advanced AI-based social robots that offer more interaction possibilities, future research could examine individuals' experience with them and develop a broader and deeper understanding

of machine companionship versus human companionship. Third, the conceptualization of companionship in our study was built upon the experiences of a limited number of participants. Such experiences might be confined by the design features of Eilik. Future research may consider exploring a wider range of social robots and recruiting participants with diverse levels of human-robot interaction experiences to better understand how our definition of companionship generalizes across different devices and populations.

Funding The study was sponsored by a university-level fellowship grant.

Data Availability Interview and interaction diary questions are included in the supplementary materials. Representative quotes around themes are included in supplementary materials: https://osf.io/svq64/view?view_only=de8d2c7444b54e40b1eacb72320cff92.

Code Availability Available upon request.

Declarations

Ethical Approval This research involves human participants and has received ethical approval from the university's Research Ethics Committee.

Consent to Participate All participants provided informed consent to participate in the study.

Consent for Publication All participants provided informed consent to the publication of this study's findings.

Competing Interests There is no conflict of interest to disclose, and this manuscript is not under consideration at any other publication outlet.

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