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Effects of Interaction Proximity and Orientation on User Experience with AI Companion Robots in Information Delivery Contexts

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Objective: This study investigates how an AI companion robot's interaction proximity and face-to-face behavior affect user experience in home environments.

Background: AI companion robots have advanced to fulfill both functional and social roles, including the delivery of personalized information. These robots commonly operate in close proximity to users, utilizing visual and auditory modalities for communication. However, the unique characteristics of home and personal environments can substantially impact user experience and acceptance. A thorough understanding of user perceptions of robot behavior in such contexts is essential for the design of effective human–robot interactions.

Method: A within-subjects experiment was conducted with 40 participants. Robot interaction was manipulated in a 2 × 2 design varying proximity (close, distant) and orientation (user-facing, wall-facing). After interacting with a robot that presented weather and schedule information, participants completed questionnaires measuring perception, acceptance, closeness, user experience, and intention to use. Follow-up interviews were conducted to collect qualitative feedback.

Results: Face-to-face interactions at close proximity received the highest ratings for intimacy, likability, personification, and social presence. In contrast, distant, wall-facing interactions were perceived as more professional and less distracting. The higher the age group, the more participants preferred human-like qualities such as eye contact, whereas younger participants valued efficiency and the robot's functional role. Comfort and intention to use were generally rated positively.

Conclusion: The interaction of AI companion robots is effective in building intimacy at close range, but more suitable for delivering information and minimizing distraction at a distance.

Application: These findings highlight the need to develop context-aware, user-tailored interaction strategies for social robots designed for home environments.

Keywords: AI companion robot, Home robotics, Human–robot interaction, User experience, Interaction distance, Orientation

1. Introduction

The social behavior of robots has long been a focus in robotics, with their ability to

interact with humans evolving beyond basic tasks. In the social dimension, robots engage with humans through gestures, facial expressions, communication, emotions, and language (Blut et al., 2021; Brandl et al., 2016; Breazeal, 2003; Breazeal et al., 2016; Dautenhahn, 1995; Fong et al., 2003; Henschel et al., 2021; Sarrica et al., 2020). Robots are categorized into various forms, such as task type (e.g., walking assistance, delivery) and robot morphology (e.g., human, animal) (Yanco and Drury, 2004). Based on their morphology, robots can foster emotional bonds with humans or perform specific tasks, such as guiding users to information or managing household responsibilities. The emotional quality of human–robot interaction has been explored in many studies, addressing factors such as acceptance (Bröhl et al., 2016; Goodrich and Schultz, 2008; Yanco and Drury, 2004). Safety (De Santis et al., 2008; Lasota et al., 2017) and likability (Kim et al., 2019; Letheren et al., 2021; Li et al., 2010; Salem et al., 2013). Social robots have already assumed social roles and become physically embodied, with users expecting usability and positive experiences based on the robot's purpose and context.

The social development of robots is shifting from performing domain-specific tasks such as those in education, healthcare, and eldercare toward the ability to actively adapt to human contexts and environments to carry out tasks autonomously (Robinson et al., 2014). The social capabilities of these robots are expanding beyond narrow applications, enabling them to identify appropriate actions and execute tasks independently. In particular, the concept of companionship is evolving to address human emotional needs and enhance quality of life through affective interactions in social settings. Social robots that serve as companions foster intimate bonds with users, increasing trust and a sense of safety (Becker et al., 2007; Strohmann et al., 2023). AI companion robots serve both social and functional roles: socially, they help foster intimacy and communication with users; functionally, they detect human activities and perform relevant tasks. When deployed in home environments for personal use, AI companion robots may act as personal assistants or partners (Aleksander, 2017; Kim et al., 2021; Montemerlo et al., 2002; Ray et al., 2008). Social aides (Cooper et al., 2020; Scopelliti et al., 2005; Wada and Shibata, 2007), or providers of personalized information, thereby facilitating the development of relational bonds between the robot and the user.

1.1 Social interaction and AI companion robots

Socially interactive robots address the psychological and social needs of users while autonomously performing specific tasks. For example, robotic vacuum cleaners are autonomous systems that navigate and sense their environment independently. IoT-based services, through learning and connectivity, are gradually reducing the need for direct user control (Huang and Rust, 2021). Some robots can actively monitor a user's health or behavioral state and provide paramedical services in response (Góngora Alonso et al., 2019; Koceski and Koceska, 2016; Tsai et al., 2007). Robots have the potential to serve as assistants and tools in a variety of daily activities (Feil-Seifer and Mataric, 2005).

Human–robot interaction offers numerous potential benefits, ranging from basic communication to advanced capabilities shaped by the robot's learning processes (Krämer et al., 2011). AI robots are advancing in their ability to interact and cooperate with humans, thereby enhancing efficiency and improving overall quality of life (Tóth et al., 2022). In particular, robots used within home environments have the potential to support users' daily activities and perform new tasks that were previously unavailable, owing to their ability to execute a wide range of functions (Smarr et al., 2014). In these settings, robots will expand their roles as companions, providing users with daily information and carrying out simple tasks. Since home environments are utilized differently depending on individual lifestyles, it is essential to consider the surrounding context and the user's field of vision when presenting information.

1.2 Robot proximity and orientation

In home environments, personal empathic experiences are essential. Robots positioned within a social distance of approximately 2.0m, rather than an intimate distance of less than 0.5m, have been shown to enhance comfort, trust, and likability (Gurung et al.,

2021; Siebert et al., 2020). However, within personal spaces, the robot's approach direction or gaze behavior may lead to negative user experiences depending on the context (DiSalvo, 2002; Lindblom et al., 2020; Mori et al., 2012). While face-to-face interactions with robots easily capture the user's visual attention, they can also evoke feelings of threat or discomfort. Furthermore, rapid approaches by robots may induce anxiety and stress in users (Brandl et al., 2016). These effects, however, may vary depending on the robot's size, morphology, operational space, and intended function.

This study examines how the approach distance and face orientation of an AI companion robot influence user experience in home environments. It particularly focuses on the effects of these factors when the robot delivers information through projection. Since the home is a private and protected space, the robot's approach and orientation can significantly shape user experience. Accordingly, this study addresses the following research questions:

- **RQ1.** How does the robot's approach distance, including user proximity and wall proximity, affect user experience in a home environment?
- **RQ2.** How does the robot's orientation, including user facing and wall facing, affect user perception when delivering projected information in home environments?

2. Method

2.1 Participants

This study was conducted with 40 participants (25 female and 15 male) in a controlled laboratory environment. Participants' ages ranged from their 20s to their 60s, with a mean age of 41.75 years. A broad age range was recruited to reflect the diverse user base of home robots. In particular, older adults, who tend to spend more time at home than younger individuals, were included to better capture their interactions with home robots. Participants were recruited through community postings, social media, and snowball sampling.

2.2 Experimental design

Each participant engaged in four interactions with the robot (Table 1). The experiment employed a 2 × 2 within-subjects design, combining two independent variables: proximity (i.e., user proximity and wall proximity) and orientation (i.e., user orientation and wall orientation). During each interaction, participants asked the robot two questions regarding the weather and their schedule, to which the robot responded by providing the relevant information.

The robot used in the experiment was constructed by attaching an iPad Air 11 to a remote-controlled robotic vacuum cleaner. To create a friendly appearance, the iPad displayed animated facial features, such as eyes and a mouth, to simulate facial expressions (DiSalvo, 2002; Fong et al., 2003) (Figure 1). The robot's movements were controlled using the Wizard-of-Oz method, in which a remote operator manually guided the robot according to a predefined script for each condition. To simulate information delivery in a home environment, the robot was designed to project information onto a wall. In the laboratory setting, an opaque screen was used to represent the wall, and information was projected from behind using a standard projector. The projected content corresponded to the two user questions.

The proximity conditions were determined based on Hall's proxemics theory (Hall et al., 1968). The near condition (user proximity) was set at 45cm, representing an intimate distance, while the far condition (wall proximity) was set at 200cm, falling within the typical range of social distances (120-360cm) and adjusted to reflect a realistic living room environment.

- **User Proximity and User Facing (UP-UF):** The robot approaches the user and orients itself such that it faces the user while delivering information.
- **User Proximity and Wall Facing (UP-WF):** The robot approaches the user but orients itself toward the wall when delivering information.
- **Wall Proximity and User Facing (WP-UF):** The robot approaches the wall (where information is projected) but faces the user while providing the information.
- **Wall Proximity and Wall Facing (WP-WF):** The robot approaches the wall and also faces the wall while delivering the information.

Table 1. User-robot interaction types

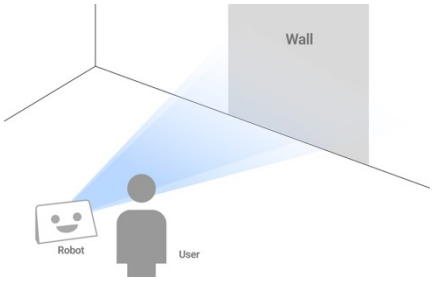
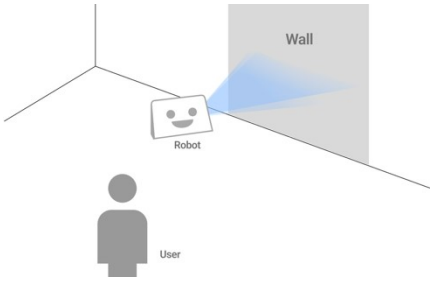
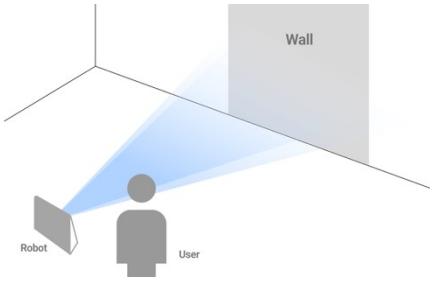
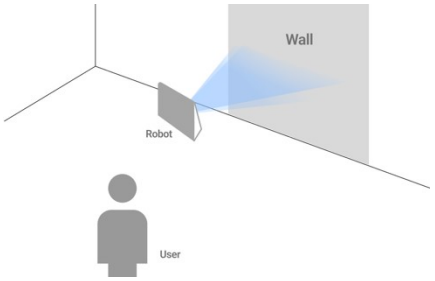
Type	User-proximity	Wall-proximity
User facing	UP-UF	WP-UF
		
Wall facing	UP-WF	WP-WF
		

Figure 1. Experimental setup

2.3 Task and procedure

Upon arrival at the laboratory, participants were introduced to the AI companion robot and watched a video demonstrating its use in a home environment. They were then asked to imagine the laboratory as their living room and to sit on chairs arranged for interaction. At the beginning of each experiment, participants asked two questions in a relaxed tone: "How is the weather today?" and "What is my schedule?" In previous studies on household robots, a variety of everyday instructions were examined, including household chores, time reminders (e.g., medication schedules), requests, and personal services. These prior studies were referenced when selecting the questions (Bugmann and Copleston, 2011; Smarr et al., 2014).

The robot moved to the designated location according to the assigned conditions, displayed the relevant information on its screen, and provided a voice response in its own voice. The order of conditions was counterbalanced to control for order effects (Bradley, 1958). After each interaction, participants completed a questionnaire to evaluate their experience. Additionally, a short semi-structured interview was conducted after each task to collect qualitative feedback. The interview questions focused on participants' impressions of the robot, their interaction preferences, and their comparative rankings of the four conditions. The experimental session lasted approximately 60 minutes.

2.4 Data collection and analysis

Participants completed questionnaires assessing perception, presence, closeness, user experience, and intention to use across different combinations of robot proximity and face orientation (Table 2). Godspeed questionnaire was adopted to measure users' perceptions of robots, encompassing the following dimensions: anthropomorphism, animacy, likability, perceived intelligence, and perceived safety. Presence was assessed to evaluate the degree of social presence experienced during interactions with the robot, while closeness was assessed using a single item from the Inclusion of Other in the Self (IOS) scale. User experience focused on participants' sense of comfort during interaction, and intention to use measured their willingness to adopt AI companion robots in future home environments. The questionnaire items for each measure are provided in the Appendix. Data were analyzed using IBM SPSS Statistics, employing a two-way repeated-measures ANOVA. Bonferroni post hoc tests were conducted to examine pairwise differences among the conditions.

2.5 Measurements

Participants completed questionnaires assessing perception, presence, closeness, user experience, and intention to use across different combinations of robot proximity and face orientation (Table 2). To measure users' perceptions of the robot, we adopted Godspeed's scale, which includes the following dimensions: anthropomorphism, animacy, likability, perceived intelligence, and perceived safety. Presence was evaluated to measure the sense of social presence experienced during interactions with the robot. Closeness was assessed using a single item that evaluated the perceived intimacy between the robot and the user. User experience focused on participants' sense of comfort during the interaction. Finally, intention to use was measured by assessing participants' willingness to adopt AI companion robots in home environments in the future.

Table 2. Overview of questionnaires and reliability

Questionnaire		Items	Cronbach's α	References
Godspeed	Anthropomorphism	5	.95	Bartneck et al. (2009)
	Animacy	6	.95	
	Likability	5	.94	

Table 2. Overview of questionnaires and reliability (Continued)

Questionnaire		Items	Cronbach's α	References
Godspeed	Perceived intelligence	5	.96	Bartneck et al. (2009)
	Perceived safety	3	.94	
Social Presence (SP)		5	.94	Heerink et al. (2008)
Inclusion of Other in the Self (IOS)		1	–	Aron et al. (1992)
Comfort		6	.97	Kim and Mutlu (2014), Lasota et al. (2017)
Willingness to Accept (WA)		3	.92	Gursoy et al. (2019), Venkatesh et al. (2012)

2.6 Data analysis

Survey data were collected using a 7-point Likert scale. Statistical analyses were performed using SPSS. A repeated-measures ANOVA was primarily employed, and a two-way ANOVA was additionally conducted depending on the dependent variable. For questionnaire items that violated the assumption of normality, the Friedman test was applied as a non-parametric alternative. To explore perspectives that were not anticipated by the researchers, post-task interviews were conducted and audio-recorded (Adams and Cox, 2008). The recorded interviews were subsequently transcribed and subjected to thematic analysis using Microsoft Excel.

3. Findings

3.1 Experimental results

Overall, the condition in which the robot faced the user at close range while providing information was evaluated positively (Figure 2). The comfort dimension consistently received high scores, which may be attributed to the relaxed posture and informal conversational tone commonly observed in home environments. In contrast, the robot received the lowest ratings on the IOS measurement items. A significant difference was found between the condition where the robot faced the user at close range and

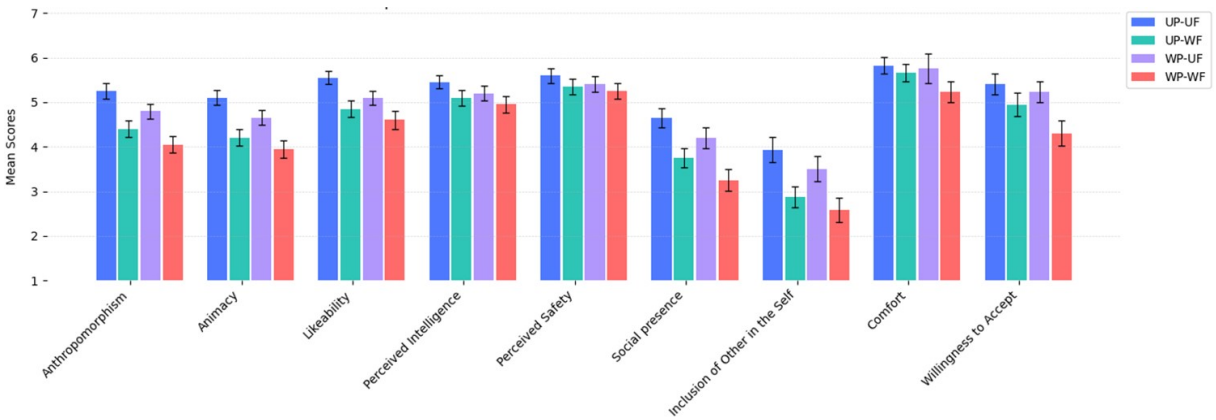


Figure 2. Comparison of overall averages

the condition where it provided guidance from a distance while facing the wall. Participants described close-range, face-to-face interaction as resembling direct conversation, and some mentioned that it felt similar to talking with a friend. Furthermore, non-face-to-face interactions conducted from a distance were evaluated negatively (Table 3).

3.1.1 User perception (godspeed)

The effects of robot-user proximity and face orientation on Godspeed's dimensions anthropomorphism, animacy, likability, perceived intelligence, and perceived safety were partially significant. Analysis results revealed significant main effects for most measures. For anthropomorphism, the main effect of proximity was significant, $F(1, 39) = 6.66$, $p = .014$, as was the main effect of orientation, $F(1, 39) = 22.99$, $p < .001$. The interaction effect between proximity and orientation was not significant, $F(1, 39) = 0.16$, $p = .692$. For animacy, both the main effect of proximity, $F(1, 39) = 11.58$, $p = .002$, and the main effect of orientation, $F(1, 39) = 20.34$, $p < .001$, were significant. The interaction effect was not significant, $F(1, 39) = 0.45$, $p = .505$. For likability, significant main effects were found for proximity, $F(1, 39) = 10.42$, $p = .002$, and orientation, $F(1, 39) = 7.81$, $p = .008$, whereas the interaction effect was not significant, $F(1, 39) = 0.01$, $p = .913$. For perceived intelligence, both the main effect of proximity, $F(1, 39) = 4.85$, $p = .033$, and the main effect of orientation, $F(1, 39) = 10.90$, $p = .002$, were significant. The interaction effect was not significant, $F(1, 39) = 0.03$, $p = .868$. For perceived safety, the main effect of proximity was not significant, $F(1, 39) = 0.52$, $p = .474$, while the main effect of orientation was significant, $F(1, 39) = 9.06$, $p = .005$. The interaction effect was not significant, $F(1, 39) = 0.31$, $p = .580$.

The Bonferroni post hoc tests revealed that, across all dimensions, the UP-UF was rated significantly higher than the WP-WF ($p < .05$), while no significant differences were found between the remaining conditions. The UP was rated significantly higher than the WP in terms of anthropomorphism, animacy, likability, and perceived intelligence. Similarly, the UF consistently received more positive evaluations than the WF condition across all dimensions.

Overall, the UP-UF was perceived most positively, whereas the WP-WF received the lowest ratings. These findings indicate that AI companion robots are perceived as more likable and socially engaging when interacting closely with users while providing information. Moreover, direct gaze contributed to increased perceptions of anthropomorphism, suggesting that such robots may be expected to serve as friendly companions in future home environments.

Table 3. Results of descriptive statistic for user experiences

Factors	UP-UF M (SD)	UP-WF M (SD)	WP-UF M (SD)	WP-WF M (SD)
Anthropomorphism	5.25 (1.10)	4.40 (1.15)	4.80 (1.05)	4.05 (1.20)
Animacy	5.10 (1.02)	4.20 (1.18)	4.65 (1.07)	3.95 (1.25)
Likeability	5.55 (0.95)	4.85 (1.15)	5.10 (1.01)	4.60 (1.30)
Perceived intelligence	5.45 (0.90)	5.10 (1.10)	5.20 (1.00)	4.95 (1.15)
Perceived safety	5.60 (1.05)	5.35 (1.12)	5.40 (1.10)	5.25 (1.15)
Social presence	4.64 (1.36)	3.75 (1.38)	4.20 (1.43)	3.25 (1.51)
Inclusion of other in the self	3.93 (1.79)	2.88 (1.49)	3.50 (1.77)	2.58 (1.72)
Comfort	5.82 (1.19)	5.66 (1.21)	5.76 (2.06)	5.23 (1.44)
Willingness to accept	5.41 (1.50)	4.94 (1.67)	5.23 (1.51)	4.30 (1.78)

3.1.2 Social presence

An analysis was conducted to examine social presence between the user and the robot. The results showed that the main effect of proximity was significant, $F(1, 39) = 20.02$, $p < .001$. Participants reported higher social presence in the UP (UP-UF: $M = 4.64$, $SD = 1.36$; UP-WF: $M = 3.75$, $SD = 1.38$) compared with the WP (WP-UF: $M = 4.20$, $SD = 1.43$; WP-WF: $M = 3.25$, $SD = 1.51$). The main effect of orientation was also significant, $F(1, 39) = 25.46$, $p < .001$, indicating that the UF elicited higher perceptions of social presence than the WF. In contrast, the interaction between proximity and orientation was not significant, $F(1, 39) = 0.04$, $p = .848$, suggesting that the two factors contributed independently to perceptions of social presence. Bonferroni post hoc tests revealed that the UP-UF produced significantly higher social presence scores than the WP-WF ($p < .05$), while no significant differences were observed between the other conditions.

These findings demonstrate that both robot proximity and gaze direction play important roles in enhancing social presence. The UP and UF independently increased perceptions of social presence, whereas the WP-WF resulted in the lowest ratings, indicating a reduction in perceived social presence. Consequently, when the robot interacted in close proximity to the user, participants perceived it as more human-like and as an entity capable of expressing genuine emotions.

3.1.3 Inclusion of other in the self

To examine the relationship between the user and the robot, an analysis of closeness was conducted. The results indicated that the main effect of proximity was significant, $F(1, 39) = 7.46$, $p = .009$. Participants reported higher IOS scores in the UP (UP-UF: $M = 3.93$, $SD = 1.79$; UP-WF: $M = 2.88$, $SD = 1.49$) compared with the WP (WP-UF: $M = 3.50$, $SD = 1.77$; WP-WF: $M = 2.58$, $SD = 1.72$). The main effect of orientation was also significant, $F(1, 39) = 28.31$, $p < .001$, showing that the UF elicited higher closeness scores than the WF. However, the interaction between proximity and orientation was not significant, $F(1, 39) = 0.18$, $p = .677$. Bonferroni post hoc tests revealed that the UP-UF produced significantly higher IOS scores than the WP-WF ($p < .05$), while no significant differences were observed between the remaining conditions.

These findings suggest that users felt a stronger sense of relational closeness with the robot when it was positioned nearby and maintained eye contact. Although there was no combined interaction effect, both proximity and face orientation independently contributed positively to the perception of closeness.

3.1.4 Comfort

The distribution of the comfort scores violated the normality assumption according to the Shapiro-Wilk test. However, after re-examining the skewness (Skewness = 1.03) and kurtosis (Kurtosis = 13.79), and considering the sample size (N = 40) along with the robustness of repeated measures ANOVA (Blanca et al., 2013), it was determined that the analysis would not be substantially distorted. Therefore, a Two-Way Repeated Measures ANOVA was conducted.

The results revealed a significant main effect of proximity, $F(1,39) = 4.64$, $p = .038$. Participants reported significantly higher comfort scores in the UP ($M = 5.82$, $SD = 1.19$; $M = 5.76$, $SD = 2.06$) compared to the WP condition ($M = 5.66$, $SD = 1.21$; $M = 5.23$, $SD = 1.44$). In contrast, the main effect of orientation was not significant, $F(1,39) = 1.84$, $p = .183$. Although the UF showed slightly higher scores than the WF, the difference was not statistically significant. Additionally, the interaction effect between proximity and orientation was not significant, $F(1,39) = 1.22$, $p = .275$. The Bonferroni-adjusted post hoc analysis indicated that the UP-UF produced higher comfort scores than the WP-WF, but this difference was not statistically significant ($p > .05$).

These results indicate that robot proximity has a significant effect on user comfort, with users reporting higher comfort when

the robot was positioned closer to them. Conversely, orientation and the interaction between proximity and orientation did not significantly affect comfort. This suggests that in home environments, users may experience comfortable interaction with a robot even when it is not directly facing them, as long as it remains in close proximity.

3.1.5 Willingness to accept

The intention to use the AI companion robot was analyzed. The results showed a significant main effect of proximity, $F(1,39) = 8.90$, $p = .005$. Participants reported higher intention to use the robot in the UP ($M = 5.41$, SD = 1.50; $M = 4.94$, $SD = 1.67$) than in the WP ($M = 5.23$, $SD = 1.51$; $M = 4.30$, $SD = 1.78$). There was also a significant main effect of orientation, $F(1,39) = 9.96$, $p = .003$. The UF resulted in higher intention to use than the WF. In contrast, the interaction effect between proximity and orientation was not significant, $F(1,39) = 1.82$, $p = .185$. The Bonferroni-adjusted post hoc test showed that the UP-UF produced significantly higher intention scores than the WP-WF ($p < .05$). No other pairwise comparisons reached statistical significance.

Both UP and UF increased the intention to use the robot compared to WP and WF. Although the interaction effect was not significant, each factor independently had a positive impact on robot acceptance. This suggests that, in the future, AI companion robots should be designed to stay close to users and engage in face-to-face communication.

3.1.6 Interviews

Through the interviews, subjective opinions regarding the interaction effects of proximity and face orientation were collected (Table 4). Participants expressed their views from both user-related and information-related perspectives, depending on individual characteristics. Most participants reported positive feelings toward the robot and described it as friendly. Some users compared the robot to a family member or pet that approaches and communicates with them. They also mentioned that the small size and friendly appearance of the robot used in the experiment made communication feel more comfortable. Participants noted that the robot's appearance and voice could be important factors in interaction and should be considered in future designs (Kirby et al., 2010; Hwang et al., 2013).

From the user perspective, participants felt that receiving information from a robot positioned nearby created a sense of connection and was more effective. They perceived the robot being distant or not facing the user as a sign of malfunction or disengagement. Opinions from this perspective focused on social interaction and emphasized the importance of human–robot connectedness. From the information perspective, some participants reported that when the robot faced the wall, even at a close distance, they were able to focus better on the information with fewer distractions. They stated that emotional exchange with the robot was not necessary and that interacting with it as a tool to deliver information was efficient and increased trust, regardless of distance. While making eye contact with the robot enhanced comfort, some participants found it distracting when focusing on information. A few participants also mentioned that the appropriate level of proximity could vary depending on the type of tasks performed at home.

Interestingly, opinions differed by age group. Older participants, who spent more time at home and perceived the robot as a companion, emphasized the importance of eye contact. They felt uncomfortable without face-to-face interaction and interpreted the robot looking at the wall as a signal that communication was unnecessary or that they were being ignored. Younger participants also valued intimacy and likability but additionally highlighted functional aspects. They considered the robot's role as a tool to be appropriate depending on the information provided and the user's context, and they evaluated facing the screen while providing information as enhancing trust in the information. While communication with users is important for AI companion robots, the level of information and the user context should also be taken into consideration.

Table 4. Summary of user interviews and example quotes

Age	Example quotes	
	Focus on user interaction	
20s	P6	"I don't know if I should call it intimacy, but there's a sense of connection that we're talking..."
20s	P19	"Up close, it's like chatting with a friend. Far away, more like a presentation."
50s	P16	"It's even more unpleasant when you're close to me and you don't look at me."
50s	P22	"... I feel like we are communicating with each other because we make eye contact."
60s	P31	"If it doesn't look at me, it feels like something's wrong... like I'm arguing with a friend."
	Focus on information delivery	
20s	P8	"I don't think a machine needs to be human, it doesn't need to have an emotional connection, so it's more about the movement... (near a wall works well)"
30s	P5	"It feels a bit distracting when giving information, so I think it's better to keep looking at the wall..."
30s	P14	"When you're near me and you're talking to me and looking at me, I can't see the information on the wall and it's distracting."
50s	P36	"I'm usually doing chores around the house, so it's okay if I don't have to be close to you."

4. Discussion

This study investigated the effects of interaction distance and face orientation on information delivery by AI companion robots in home environments. The results showed that user experience was enhanced when the robot provided information from a close distance. Although users often prefer a comfortable distance rather than very close proximity (Babel et al., 2021), the findings of this study demonstrated that an appropriate level of proximity can be applied to users' personal spaces, indicating potential for further research expansion.

When the robot faced the user, participants perceived it as more friendly and companion-like, and they reported feeling less pressured to maintain eye contact even when the robot approached them. In all conditions, facing the user was evaluated more positively than facing the wall. This effect was particularly pronounced among older participants, who preferred the small robot used in the experiment and emphasized companionship (Wu et al., 2012; Torta et al., 2014). Comfort was rated the highest among all dimensions, suggesting its importance in home environments and highlighting the potential for AI companion robots in daily life. This context also appeared to influence usage intention, as face-to-face interaction was positively evaluated for its non-intrusive and approachable nature.

With respect to social presence, close interaction with the user received the highest ratings, although distant interaction was also positively evaluated in specific contexts. Participants described distant face-to-face interactions as resembling communication with an actual person, possibly due to the socially acceptable nature of such interactions (Gurung et al., 2021). In terms of relational closeness, the lowest evaluations were observed when the robot was perceived as more mechanical. Younger participants were less likely than older participants to include the robot in their social relationships, possibly because they viewed the robot as a tool and evaluated its role more objectively.

Furthermore, participants indicated a higher intention to use the robot when it was positioned close to them. Face-to-face interaction was positively received, promoting emotional acceptance and enabling continuous interaction. AI companion robots

demonstrated the ability to understand user intentions and adapt to user needs, suggesting that interacting closely with users while meeting their requirements will be an essential advantage. The results also revealed significant differences between conditions in which the robot was near and facing the user versus near and facing the wall. Participants felt that remaining close while providing information enhanced their positive perceptions of the robot. For continuous use in home environments, familiarity with the robot is crucial. Unlike professional settings, high levels of technical expertise are not required in home environments. Although interaction distance and engagement may vary depending on the importance and complexity of the content, the personal and cozy nature of home settings underscores the importance of closeness with the robot. As AI companion robots continue to evolve, their interactions are expected to expand beyond information delivery to include integration with various types of content and AI services. Additionally, such robots can provide information without constraints related to screen size, offering opportunities for deeper research on user approaches, behaviors, and attitudes. This study contributes to predicting user experiences and serves as a basis for the development of advanced AI companion robots.

5. Limitation and Future Work

Despite its contributions, this study has several limitations. First, although home robots are expected to be used frequently in daily life, this experiment was based on a single interaction. Human–robot social interaction begins with relationship-building and can develop through emotional communication (Duffy, 2003). Future studies should examine long-term use and perception. Moreover, the equipment used in this experiment was an electronic device designed to appear as an autonomous robot, which may have influenced participants' perceptions depending on their age and familiarity with technology. The robot's appearance may also affect the level of acceptance and should be considered in future research (Lehman et al., 2020). While users generally hold positive perceptions of home robots (Scopelliti et al., 2005), these perceptions may vary depending on the type of information provided. The information used in this study involved common daily topics; however, users' behavior may change depending on the importance and urgency of the information. Privacy concerns and individual differences in sensitivity to personal data should also be taken into account in future research.

6. Conclusion

This study investigated how the behavior of AI companion robots designed to assist users in home environments influences user experience. The findings revealed that face-to-face interaction at close proximity during information delivery was evaluated most positively, being perceived as comfortable and intimate. When the robot delivered information from a distance or avoided facing the user, evaluations were generally lower, and participants tended to perceive issues in the relationship with the robot. Regarding intention to use, robots that remained close to the user were rated more highly, even when simply delivering information. These results suggest that robots ensuring close proximity have the potential to enhance daily life and provide meaningful assistance in home environments. Furthermore, the findings offer practical insights into interaction strategies and communication behaviors for personalized robots operating within personal spaces.

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Appendix

각 설문 문항에 응답해주시기 바랍니다.

■ **Godspeed (24)**

1. Anthropomorphism

	1점	2점	3점	4점	5점	6점	7점	
가짜 같은								자연스러운
기계적인								인간 같은
의식이 없는								의식이 있는
인공적인								생명체 같은
어색한 움직임								자연스러운

2. Animacy

	1점	2점	3점	4점	5점	6점	7점	
죽어있는								살아있는
생기가 없는								생기 있는
기계적인								유기체 같은
인공적인								생명체 같은
활발하지 않은								상호작용적인
무반응인								반응하는

3. Likeability

	1점	2점	3점	4점	5점	6점	7점	
싫은								좋은
친해지기 어려운								친해지기 쉬운
불친절한								친절한
불쾌한								유쾌한
형편없는								좋은

4. Perceived Intelligence

	1점	2점	3점	4점	5점	6점	7점	
무능한								유능한
무지한								박식한
무책임한								책임감 있는
무식한								지적인
어리석은								현명한

5. Perceived Safety

	1점	2점	3점	4점	5점	6점	7점	
불안한								안정된
동요되는								차분한
놀란								평온한

■ **Social Presence (5)**

1. 나는 로봇과 교류할 때 나는 실제 사람과 대화하는 것처럼 느꼈다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

2. 나는 때때로 로봇이 정말 나를 보고 있는 것처럼 느꼈다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

3. 나는 로봇이 살아있는 생명체라고 상상할 수 있다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

4. 나는 종종 로봇이 실제 사람이 아니라고 생각한다.* (1점:동의하지 않음 ~ 7점:동의함)

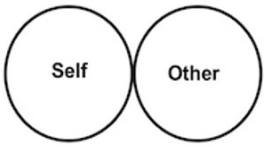
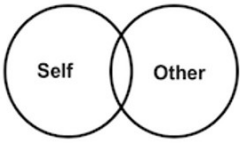
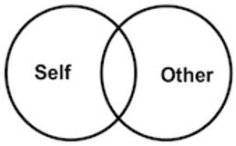
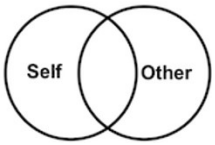
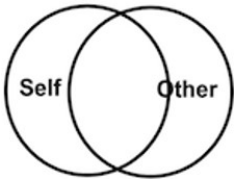
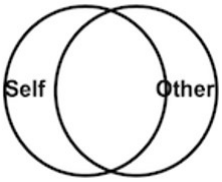
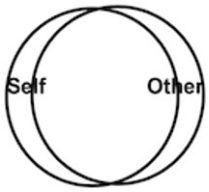
1점	2점	3점	4점	5점	6점	7점

5. 때때로 로봇은 진짜 감정을 가지고 있는 것처럼 보인다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

■ Inclusion of Other in the Self (IOS)

1. 어떤 그림이 당신과 로봇의 관계를 가장 잘 표현합니까? (1개 체크해 주세요.)

■ Comfort (6)

1. 로봇과 상호 작용하는 것은 나에게 불편하다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

2. 로봇과 상호 작용하는 것은 나에게 불안하다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

3. 로봇과 상호 작용하는 것은 나에게 어렵다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

4. 로봇과 상호 작용하는 것은 나에게 짜증나는 일이다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

5. 로봇과 상호 작용하는 것은 나에게 혼란스럽다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

6. 로봇과 상호 작용하는 것은 나에게 실망스러운 일이다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

■ **Willingness to Accept (3)**

1. 나는 집에서 이 로봇을 이용할 의향이 있다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

2. 나는 집에서 이 로봇과 상호작용하는 것이 기쁘다고 느낀다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점

3. 나는 집에서 이 로봇과 상호작용할 것 같다. (1점:동의하지 않음 ~ 7점:동의함)

1점	2점	3점	4점	5점	6점	7점