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Following to Talk: Effects of Mobile Robot Guidance on Dialogue Motivation in a Field Trial

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***Abstract*— Since robots are often disregarded in public interactions, many studies have examined how nonverbal cues and dialogue strategies encourage users to initiate engagement. However, the impact of robot "movement" remains insufficiently investigated. This study examined the psychological effects of movement behavior on willingness to engage in dialogue in a scenario where a mobile guide robot leads people to a stationary robot. A field experiment in a shopping mall showed that guidance by a mobile robot significantly increased dialogue duration, whereas no correlation was found between moving distance and willingness to engage. These results suggest that physical commitment induced by guided movement may enhance user motivation, and that interaction designs leveraging movement behavior may be important for advancing the social implementation of interactive robots.**

***Index Terms*—Field experiment, Human-robot interaction, Mobile robot.**

I. INTRODUCTION

SOCIAL robots are deployed in various real-world settings, including museums [1], schools [2], shopping malls [3][4], and nursing facilities [5], yet they are often ignored in public environments [6]. This highlights the need to identify behaviors that effectively motivate users to engage in dialogue. To address this issue, many studies have examined how various robot behaviors and dialogue strategies, including gaze [7], gestures [8], self-disclosure [9], and turn-taking [10], can attract users' attention and promote engagement by influencing their willingness to interact. However, many of these studies did not consider the movement of robots, and the effects of robot movement on users' willingness to engage in dialogue remain insufficiently examined. Mobile robots are increasingly prevalent in everyday scenarios such as food delivery in restaurants and facility security. For example, mobile robotic avatars "Oli" have been introduced in a café [11], and Knightscope's autonomous security robot "K5" [12] has been implemented in airports and commercial facilities. Although such mobile robots are increasingly present in daily life, those specifically designed for interaction remain limited in deployment. This study focused on guide robots, assuming a scenario in which a mobile robot leads a person to a location where a stationary dialogue partner robot is positioned. In this scenario, we considered that the mobile robot, by leveraging its mobility to proactively approach visitors, and the stationary robot, by spending more time providing detailed explanations, could share roles and thereby improve the overall efficiency of interaction. In such a situation, the act of physically "moving" to a destination may itself have a psychological effect. Therefore, this study aimed to clarify the impact of guidance by a mobile robot on changes in the willingness to engage in dialogue. According to Cialdini's consistency principle [13], people tend to align their subsequent behavior with their prior voluntary actions. Following this idea, we considered that physically moving toward a destination guided by a robot could be perceived as an intentional act, thereby increasing psychological commitment and willingness to engage in dialogue. Therefore, we proposed the following hypothesis:

Hypothesis 1: A mobile robot that guides a person to the location of a dialogue partner enhances a person's willingness to engage in conversation.

Hypothesis 2: Longer distances guided by a mobile robot to a dialogue partner increase the motivation for dialogue engagement.

To test these hypotheses, we conducted a field experiment (Fig. 1), where a mobile robot approached visitors, initiated conversations, and guided them to a stationary robot.

II. RELATED WORKS

While mobile robots are common in public spaces, studies on movement in interactive or dialogue-focused scenarios remain scarce. This section reviews key related work, including single-robot interaction and mobile dialogue systems.

A. Mobile Robots

Most studies on mobile robots have focused on functional or task-oriented applications, such as navigation, delivery, or guidance. However, some studies have investigated mobile robots designed to interact socially with humans. Shi et al. demonstrated that a robot distributing flyers is more effective when it strategically approaches pedestrians than when it remains stationary [14]. Similarly, Yamaoka et al. showed that a robot introducing products while moving in consideration of the O-space is more likely to be attended to than one that

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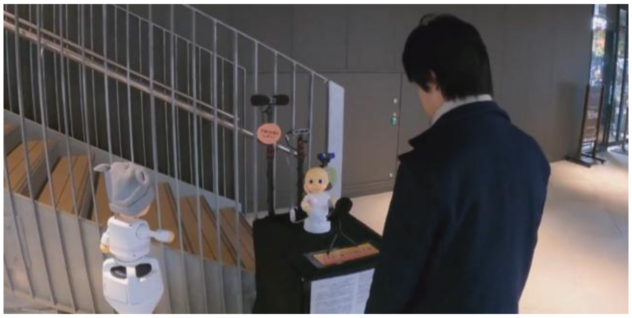


Fig. 1. Experimental scene. The mobile robot is guiding a visitor to the stationary dialogue robot

remains stationary [15]. Other studies have explored how robots can encourage human behaviors. For instance, Shiomi et al. demonstrated that a robot guiding people to a specific store by walking backward can lead both the interacting individual and accompanying bystanders who are not directly engaged [16]. Furthermore, Iwasaki et al. showed that in a task in which a robot guides a person to a location where another agent is present, the robot can prompt movement without causing discomfort by vertical oscillation in place and by looking back at the person's position [17]. However, these studies mainly focused on how robots guide or attract people through movement, without examining how such guiding behavior may affect subsequent dialogue or how multiple robots might collaborate in this process.

B. Dialogue Promotion Strategy

Several methods have been proposed in previous studies to promote dialogue between humans and robots. For example, Nishio et al. demonstrated that using two robots can reduce a user's perception of the dialogue breakdowns, thereby facilitating smoother interaction and extending dialogue duration between humans and robots [5]. In addition, various nonverbal expressions have been shown to effectively convey emotions [18][19] and accurately transmit verbal information [20][21]. Furthermore, strategies for promoting dialogue between humans and robots, as well as methods for promoting human-to-human interactions have been proposed. For instance, Traeger et al. demonstrated that when a robot shares personal stories and enhances the sense of group cohesion, it can encourage prolonged conversations among group members [22]. While many studies have proposed dialogue strategies to promote dialogue between humans and robots, few have integrated robot movement itself as part of a dialogue promotion strategy.

III. Method

A. System

In this study, we developed an integrated robot system consisting of a mobile humanoid robot and a fixed conversational robot to investigate how physical guidance influences users' willingness to engage in dialogue. The system was designed for the mobile robot to approach a person, engage in brief interaction, and guide them to the fixed robot for further conversation. As shown in Fig. 2, the system comprises two components: the Mobile Robot and the Fixed Robot. We used the humanoid mobile robot "Mobile Teleco" (Fig. 2), which consists of a mobile rover at the bottom and a humanoid robot "Teleco" mounted on top, connected by a cylinder. The rover moves forward, backward, and rotates left and right. The upper robot, Teleco, is a tabletop humanoid with 2 DoF at the waist, 2 DoF in each arm, and 3 DoF in the head, and includes a head-mounted display for facial expressions. Mobile Teleco also has a cylinder enabling vertical oscillation. Its movements can be remotely controlled via PC. The fixed robot was "CommU," a humanoid conversational agent with 14 DoF (Fig. 2): 2 DoF at the waist, 2 DoF in each arm, 3 DoF in the neck, 3 DoF in the eyeballs, 1 DoF in the eyelids, and 1 DoF in the mouth. CommU could also be remotely operated via PC for control.

1) **Mobile Robot Part**

To enable "Teleco" to address and direct its gaze toward participants, distance data acquired by a 2D-Lidar mounted on the lower part of the rover was processed using a Leg Tracker [23] to obtain the standing position of the participant. Furthermore, audio input from a microphone mounted on Teleco's head was processed using the WebSpeechAPI for speech recognition, enabling the system to acquire the participants' utterances. The Scenario Manager used these utterances and position data to generate persuasive dialogue for guiding the participant toward "CommU." The dialogue was generated using a large language model (GPT-4o) provided by OpenAI. The generated dialogue was passed to

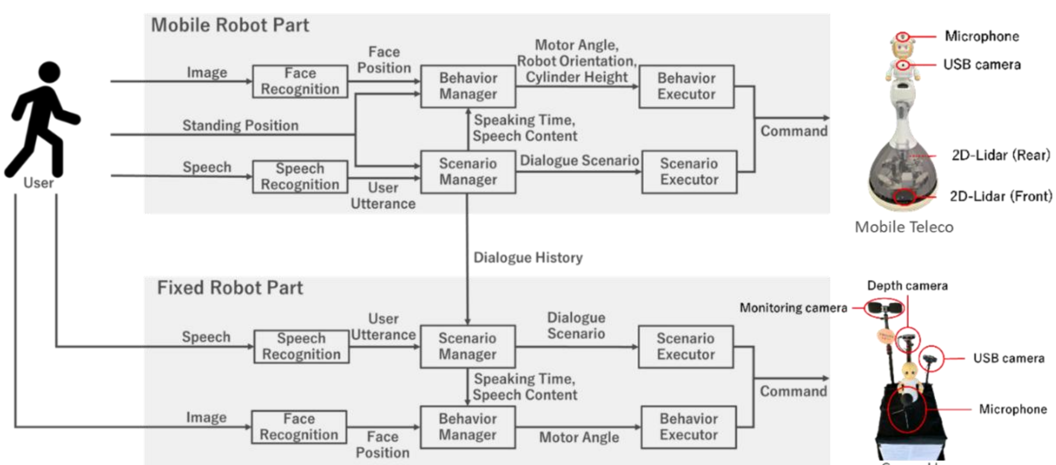


Fig. 2. System architecture showing the information flow for sensing, dialogue, and behavior in the mobile and fixed

the Scenario Executor, which issued speech commands to "Teleco" as appropriate. Speech synthesis software was used for the verbal output. In addition, video input from a USB camera mounted on Teleco's chest was processed using MediaPipe Face Detection, provided by Google, to acquire the participant's facial position (Face Recognition). These facial position data, along with the participant's standing position and the timing and content of the dialogue from the Scenario Manager, were sent to the Behavior Manager. The Behavior Manager calculated the motor angles for gaze control, orientation of the rover, and vertical position of the cylinder. These commands were sent to the Behavior Executor, which issued real-time motion commands to "Teleco" and the rover. To implement autonomous navigation, we used Nav2 [24], a modular navigation framework. The navigation system controlled the mobile robot to move at a constant speed of 0.5 m/s. The robot constructs a 2D occupancy grid map of the environment using LiDAR data and plans a global path to the fixed robot using A*-based planning. Obstacle avoidance and real-time localization were continuously updated to allow smooth guidance from the participants, even in dynamic environments.

2) **Fixed Robot Part**

The content of the CommU conversation was designed around a casual discussion related to Expo 2025 in Osaka, Japan. The robot shared the trivia, asked questions, and responded to the participants' remarks. As shown in Fig. 2, the participants' speech was captured using a microphone placed in front of the CommU and processed using the same speech recognition method applied in the Mobile Robot. In addition to the participants' utterances, their dialogue history with Mobile Teleco was passed on to the Scenario Manager. The generated response was sent to the Scenario Executor, and a speech command was issued to the CommU. To emphasize that CommU is a different robot from Mobile Teleco, the synthesized voice was modified in terms of pitch and speech speed. Furthermore, to allow the CommU to address and gaze at the participant, the facial position data obtained from the camera placed behind the CommU were passed to the Behavior Manager. Based on this information and the utterance content, the motor angles for the gaze direction and arm motion were calculated. These parameters were then sent to the behavior executor, enabling the CommU to perform appropriate action.

B. Experimental Settings

This study was approved by the Ethics Committee of our institution. The experiment was conducted at a shopping mall in Osaka, Grand Green Osaka, and targeted visitors. As indicated by the solid blue line in Fig. 3(a), the enclosed area was designated as the experimental area, and visitors entering this area were treated as participants. If no people were present in the experimental area, the region shown in Fig. 3(a) was divided into two sections. The mobile robot then moved within either Area 1 or Area 2, each approximately 1.5 meters wide near the center of its respective section. Two separate standby areas were prepared to introduce variations in the distance from the robot's starting point to the CommU's location, which was necessary to test Hypothesis 2. The CommU was placed in the position shown in Fig. 3(b).

C. Conditions

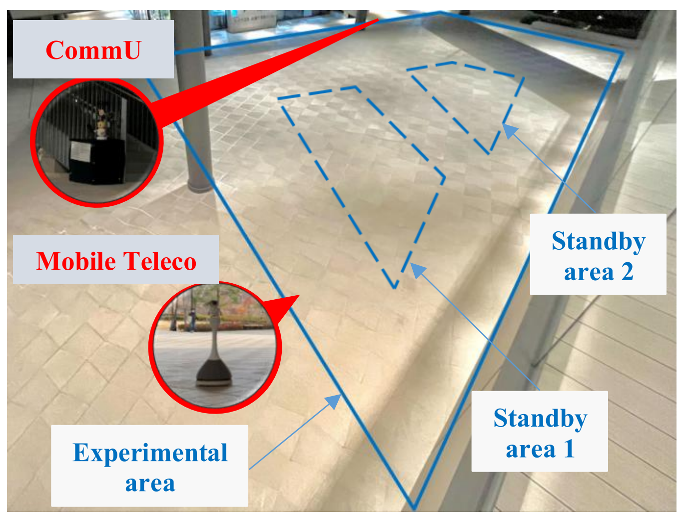
To test the hypotheses described earlier, we established two experimental conditions, no-guide and guide, as detailed below.

1) **No-guide Condition**

This condition involved participants moving on their own to the CommU location and interacting with it directly. First, using a depth camera (Fig. 2), the system detected people. When a person is detected within approximately 2m of the camera, the CommU greets the person. The CommU waited for a response for five seconds before initiating a conversation about Expo 2025 in Osaka. When the participants attempted to end the interaction, the robot autonomously encouraged them to respond to the questionnaire, after which the experimenter prompted them to complete it. If there were only a stationary robot in the experimental area, attracting visitors' attention and interest could potentially differ compared to the coexistence of both a mobile and a stationary robot. To control for situational differences across conditions, we activated the Mobile Teleco in the no-guide condition and conducted interactions with visitors. In this case, however, instead of guiding participants to the location of CommU, the Mobile Teleco engaged in the same conversation topic about Expo2025 in Osaka as used by CommU.

2) **Guide Condition**

Under this condition, when a participant entered the area, Mobile Teleco approached the participant. However, in the actual field environment, it was difficult to cover such a wide



(a) Top view

(b) Side view

Fig. 3. Experimental environment showing the positions of the two robots and the experimental and standby areas.

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area with sufficient accuracy using the robot's sensors alone. Therefore, the experimenter continuously observed the experimental area and manually activated the approach function by designating the person's location on the map as the target destination when a person entered the region marked as "Experimental area" in Fig. 3(a). After activation, Mobile Teleco autonomously approached the nearest person detected by the 2D LiDAR sensor. When the person came within approximately 2m radius, Mobile Teleco automatically initiated a greeting. After the participant replied to Mobile Teleco's speech three times, it introduced CommU and guided the participant to its location. When the distance between Mobile Teleco and CommU dropped below approximately 2m, Mobile Teleco informed CommU that it had brought a guest and handed over dialogue. From that point, the conversation proceeded in the same manner as in the no-guide condition and ended with a questionnaire. If a participant refused to follow a Mobile Teleco or moved more than approximately 3m away, the robot performed a turning motion to face the participant [14], re-approached them, and resumed the interaction. In both conditions, if the robot failed to recognize the participant's speech, both Mobile Teleco and CommU automatically encouraged the participant to speak louder and closer.

D. Participants

A total of 268 visitors participated in this experiment (no-guide condition: 161 participants; guide condition: 107 participants). After excluding participants affected by technical issues (6 in the no-guide condition and 3 in the guide condition), 259 participants successfully interacted with the robots (no-guide: 155; guide: 104). Because Mobile Teleco was also activated in the no-guide condition, some participants interacted with CommU after having first interacted with Mobile Teleco. However, because the purpose of this study was to examine the effect of guiding behavior on dialogue motivation, all participants who had interacted with Mobile Teleco were excluded from the analysis to avoid the possibility that their willingness to engage with CommU had already been diminished. Among the remaining participants, 45 participants in the no-guide condition and 22 participants in the guide condition engaged in conversations with the CommU. Finally, 23 participants in the no-guide condition (14 males, 9 females) and 18 participants in the guide condition (6 males, 12 females) completed the questionnaire. Participants' ages ranged from 7 to 70 years (no-guide: M = 35.4, SD = 16.1; guide: M = 34.0, SD = 13.9).

E. Evaluation

1) Questionnaire Analysis:

Participants' willingness to interact with the CommU was assessed using the following three items adapted from a previous study [25]. A 7-point Likert scale was used (1 = Not at all applicable; 7 = Very applicable).

Q1: Would you like to talk with CommU again?
Q2: Would you like to talk more with CommU?
Q3: Would you like to talk with CommU on another day?

2) Behavior Analysis:

In this study, the duration of the interaction between CommU and participants was used as a behavioral measure of their willingness to engage in dialogue [26]. To ensure accurate measurement, videos of the interactions were reviewed by two independent annotators blind to the study purpose, who recorded the dialogue durations. For consistency across conditions, duration was defined as the time (in seconds) from CommU's "Hello" to the moment the participant stepped away. We also conducted qualitative observations of participant behavior, noting nonverbal reactions and open-ended responses indicating interest and engagement.

IV. Result

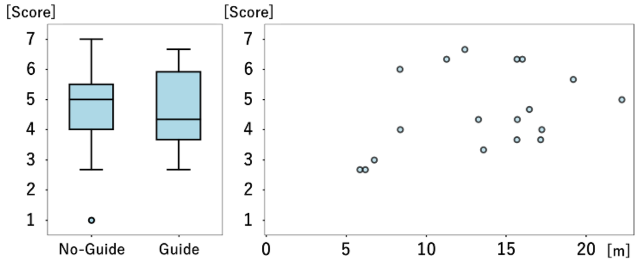
The experiment was conducted over four consecutive days, from December 26 to 29, 2024. The no-guide condition was implemented on December 26 and 28, while the guide condition was conducted on December 27 and 29.

A. Questionnaire Analysis

First, Cronbach's alpha coefficient was calculated for the three questionnaire items related to motivation to talk with CommU, yielding coefficient of 0.80, indicating a high internal consistency. Therefore, the composite scores of these items were used for analysis. Next, a Shapiro-Wilk test was conducted to assess the normality of the motivation data. The results indicated a normal distribution in both conditions (no-guide condition: $W=0.96$, $p=0.53$; guide condition: $W=0.92$, $p=0.15$). An F-test was conducted to verify the homogeneity of variance, revealing no significant difference between the two groups ($F(17, 22)=0.95$, $p=0.54$). Therefore, an independent sample t-test was performed on the mean evaluation scores for each condition. As shown in Fig. 4, the guidance condition had no significant effect on motivation to talk with CommU ($t(39)=0.14$, $p=0.89$, $d=0.044$). Furthermore, a Pearson's product-moment correlation test was conducted to examine the relationship between participants' travel distance and subjective evaluation scores. The results indicated no significant correlation ($r=0.36$, $df=17$, $p=0.14$).

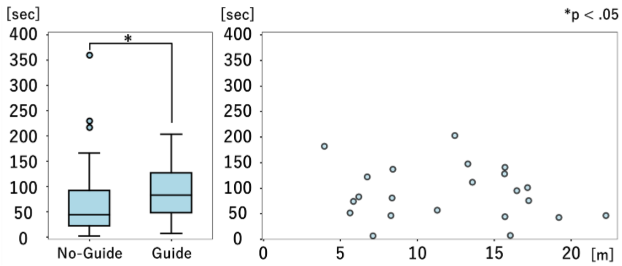
B. Behavior Analysis

First, to verify the agreement between the two annotators regarding the annotation of dialogue duration, we calculated the intra-class correlation coefficient (ICC) [27]. The results indicated a high level of agreement (ICC(2, 1)=0.99; 95% confidence interval: 0.99-1.00). Therefore, we used the average of the two annotations as data for analysis. Next, the Shapiro-Wilk test was conducted to assess normality of the interaction duration data. The results showed normal distribution in the guide condition ($W=0.97$, $p=0.67$), but not in the no-guided condition ($W=0.77$, $p<0.001$). Therefore, a Mann-Whitney U test was performed. As shown in Fig. 5, interaction duration was significantly longer in the guide condition than in the no-guide condition ($Z=-2.29$, $p<0.05$, $r=0.28$). Finally, we conducted a Spearman's rank correlation analysis to examine the relationship between the participants'



(a) Condition comparison (b) Duration–distance relationship

Fig. 4. Results on motivation to talk.



(a) Condition comparison (b) Duration–distance relationship

Fig. 5. Results on duration of dialogue.

travel distance and interaction duration. The results showed no significant correlation between travel distance and interaction duration (r=-0.18, df=20, p=0.41).

V. Discussion

A. Pre-Dialogue Motivation to Talk

As shown in Fig. 6, under the guide condition, 22 out of 104 individuals who were spoken to by Mobile Teleco (21.2%) engaged in conversations with the CommU. Under the no-guide condition, 45 of 155 individuals spoken to by CommU (29.0%) engaged in conversations with CommU. In the guide condition, unlike the no-guide condition, only those brought by Mobile Teleco interacted with the CommU. Therefore, it is possible that only individuals who already had a high motivation to talk with the CommU engaged in dialogue. To investigate whether there was an inherent difference in pre-dialogue motivation between the conditions, we conducted a z-test comparing the proportion of people who interacted with the CommU among those approached by each robot. A person was defined as having talked with CommU if they directed their gaze toward it during its second utterance, excluding its initial greeting. As shown in Fig. 6, there was no significant difference between the two conditions (z=1.41, p=0.15, h=0.18). Therefore, it can be concluded that there was no substantial difference in motivation to talk with CommU between the two conditions prior to the dialogue.

B. Relation Between Robots' Guiding and Dialogue Motivation

The results on interaction duration showed that participants in the guide condition engaged in significantly longer conversations with CommU than those in the no-guide condition. Therefore, the guiding behavior of the robot enhanced participants' motivation to interact. However, no significant effect of the guidance was observed in the

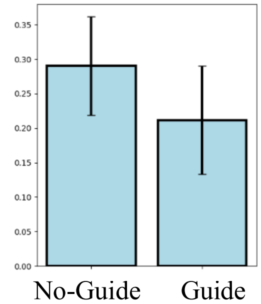


Fig. 6. Proportion of individuals who talked with CommU among those approached by the robot.

subjective evaluation. A possible reason for this discrepancy is that the questionnaire was administered after the interaction with the CommU ended. Therefore, it is likely that the motivation to talk with the CommU gradually decreased during the conversation, and by the time the dialogue ended, participants in both conditions had reached a state of fulfilled conversational desires. Nevertheless, it is also possible that participants were not consciously aware of their increased motivation, but that this effect was reflected unconsciously in their behavior, leading to longer dialogue durations. To sustain the motivation to interact better, incorporating dialogue strategies that convey the robot's interest in the human conversation partner, such as showing attentiveness [28], may be effective.

C. Relation Between Moving Distance and Dialogue Motivation

No significant correlation was found between the participants' travel distance and the duration of interaction with the CommU or their subjective motivation scores. Therefore, these results were considered consistent. A possible reason for the lack of correlation is that travel distances (approximately 4-23 meters) may not have provided a sufficiently wide difference in the physical effort required to induce variation in commitment.

D. Qualitative Observations of Participant Behavior

During the experiment, several participants spontaneously smiled, waved, or slowed their pace when approached by Mobile Teleco. These nonverbal behaviors suggest that the robot's physical movement effectively attracted participants' attention and initial interest. In the open-ended questionnaire responses, 11 out of 23 respondents mentioned that they found the interaction "interesting" or "engaging," indicating that many participants were curious and positively disposed toward interacting with the robots. In the guide condition, many participants followed Mobile Teleco. However, since Teleco's movement speed was 0.5 m/s, slightly slower than the average human walking speed, some participants appeared to find it somewhat difficult to adjust their pace. This speed difference may have influenced their motivation to engage in dialogue. The adjustment of various parameters related to the guidance behavior, including the robot's moving speed, remains an important topic for future work.

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E. Limitation

Due to the nature of the field experiment, participants varied widely in age, but many declined the questionnaire, making age-specific analyses infeasible. Although the two conditions were conducted over the same number of days, external factors such as crowd conditions and weather may have contributed to differences in participant numbers. These remain important topics for future work. Practical constraints in the shopping mall limited control over participant behavior and detailed data collection, so the study design focused on essential measurements without disrupting visitors' natural behavior. Further laboratory investigations will be important to validate and extend these findings.

VI. Conclusion

This study examined a scenario in which a mobile guide robot leads a person to a stationary dialogue robot and empirically evaluated how such guiding behavior affects users' motivation to interact. A field experiment showed that participants guided by the mobile robot engaged in significantly longer interactions with the fixed robot than those who were not. Although no correlation emerged between travel distance and motivation, this may have resulted from limited variability in distance. These findings offer practical design insights for interactive robots in public environments, suggesting that incorporating physical movement can attract users' attention and promote voluntary engagement. Coordinated behaviors between mobile and stationary robots may further enhance interaction efficiency and user experience in multi-robot systems.

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